SCIENCE

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NATIONAL ACADEMIES AND THE PROGRESS OF RESEARCH

III. THE FUTURE OF THE NATIONAL ACADEMY OF SCIENCES[1]

IN previous papers of this series[2] we have traced the development of European academies and observed the powerful influence they have exercised on the advancement of research; we have watched the beginnings of scientific investigation in the United States, and their public recognition by act of Congress establishing the National Academy of Sciences; and we have followed the history of the Academy during the half century which has elapsed since its origin. In view of the great part which academies have played in the past, and the fact that the rapid development of original research in this country has carried us out of the pioneer period, the National Academy now faces an exceptional opportunity to impress its influence upon the future scientific work of the United States. But if it enjoys an opportunity, it also faces a duty, imposed upon it by its national charter and by its position as the sole representative of

[1] This paper was presented at the Baltimore meeting of the National Academy in November, 1913. By action of the council, a manuscript copy was subsequently sent by the home secretary to each member of the academy for criticism and comment. In preparing the paper for publication, the author has had the advantage of seeing these replies. Except for a few minor verbal changes, the text is printed in its original form, with the addition of new paragraphs in square brackets.

[2] I. "The Work of European Academies," SCIENCE, 38, 681, 1913. II. "The First Half Century of the National Academy of Sciences," SCIENCE, 39, 189, 1914.

America in the International Association of Academies. The history of the Academy shows that it has taken its obligations seriously, by complying with requests from the executive and legislative departments of the government for advice on scientific matters, by the use of trust funds for the advancement of research, by the award of prizes and grants for investigation, by the initiation and support of international cooperation in research, and by such other means as its limited endowment has permitted. But while the rapid growth of the scientific bureaus of the government has reduced the number of questions which would otherwise be submitted to the Academy, the enormous increase in the wealth of the country, and the expansion of its trade relations have raised new problems and advanced new opportunities. These developments, which have resulted in the multiplication of universities, observatories and laboratories, and the foundation of great endowments for research, place the Academy in a new position, and impose the question whether it can not now accomplish much more than was formerly possible. It is the purpose of this paper to open the discussion of this question, in the hope that its further consideration by other members may lead to an extension of the work and usefulness of the Academy.

Fortunately we may take advantage of the rich store of experience accumulated by the European academies during their long histories. In seeking to adapt this to our own needs, we must of course recognize the special conditions existing in the United States. The great area over which our members are distributed and the lack of any such centralization as we see in London or in Paris, will always stand in the way of weekly meetings like those of the Royal Society and the Paris Academy. But if we can not hope to see our leading investigators personally demonstrate each step in their progress before academic audiences, as Faraday and Pasteur and many another have done abroad, we can nevertheless provide for lectures and papers illustrated by experiments in connection with the semi-annual meetings of the Academy, and possibly for others of a public character, extending throughout the year, after the manner of the Royal Institution of London. The disadvantage of our members in being unable to read accounts of their latest advances before weekly meetings of their colleagues can also be largely offset by the publication of *Proceedings*, in which the first results of all new work may be adequately presented. Thus, though we lack some of the advantages of centralization, these may be largely overcome, while retaining the very great advantage of a widely distributed membership representing the scientific interests of every section of the country.

Functions of a National Academy

The criticism has sometimes been directed against academies covering the whole range of knowledge that their place has been sufficiently filled by the special societies devoted to particular branches of science. For more than a century the Royal Society and the Paris Academy served all the purposes of science in Great Britain and France, but toward the end of the eighteenth century special societies began to develop in England. The establishment of the Linnean Society in 1788 did not appear to give special concern to the members of the Royal Society. But when the Geological Society was instituted in 1807, Sir Joseph Banks, then President of the Royal Society, united with Sir Humphry Davy and others in a strenuous attempt to amalgamate it with the parent body. The Royal Astronomical Society was established in

1820, partly as the result of the accumulation of valuable observations too extensive for the Royal Society to publish. Sir Joseph, though he had himself aided in the establishment of the Linnean Society, was greatly perturbed at this further development. A short time later he died in the belief that the special societies had struck a severe blow at the respectability and usefulness of the Royal Society, by robbing it of many of its members and laying claim to some of its most important departments.[3] But his fears were wholly unwarranted, and the special societies continued to grow and multiply, to the advantage of science and of the Royal Society itself. Their extensive publications have not detracted from the volume or the quality of the *Philosophical Transactions* and the *Proceedings*, and each of these societies, by contributing to the development of some special field, has helped to build up that great organization of British science of which the Royal Society is the acknowledged and venerated head.

These details will not be out of place if they help to emphasize a principle which should always be respected in the work of the National Academy. The societies and journals which have been established to meet the needs of scientific progress have come to stay. It is neither necessary nor in any way desirable to usurp their functions, which are the result of a natural process of evolution. There is ample room, however, for academies devoted to the whole range of science. The rapid advance of research in a thousand ramifying fields has left much intermediate territory unexplored. The approach to these undeveloped regions may be made from more than one direction, and through the aid of more than one method. Thus nothing can be more stimulating to the progress of research than an acquaintance with the investigations and processes which are constantly being developed in fields other than one's own. Mathematics has received its principal impulses from astronomy and physics. Physical chemistry is indebted, on the one hand, to Pfeffer the botanist for the study of vegetable cells, and on the other to the mathematical and physical investigations of Willard Gibbs, Van der Waals and Arrhenius. Astrophysics came into existence through the use in astronomy of the spectroscope and other physical instruments. Every department of science sheds a luster which should illuminate, not only its particular territories, but others, near and far, occupied by other workers. The importance of recognizing and utilizing this fact must therefore increase as time goes on.

[It has been truly said that an academy can hope to accomplish large results only as it succeeds in meeting the conditions of the present rather than those of the past. What are existing conditions in science? Surely none is more striking than the contraction of the field of the average investigator. Specialization is inevitable in the maze of modern progress, and the narrowing effect of constant devotion to a single subject must become still more apparent as science ramifies further. A general academy, by insisting on the importance of large relationships, by demonstrating the unity of knowledge, by recognizing the fact that fundamental methods of research, wherever developed, are likely to be applicable in more than one department, can do much to broaden and to stimulate its members. The correlation of research should be counted as one of its prime objects, and its energies should be largely directed to this important end.]

We are thus led to the conclusion that

[3] Barrow, "Sketches of the Royal Society," pp. 10, 256; Weld, "History of the Royal Society," pp. 242, 246.

the functions of a National Academy should be of the broadest character, and that the advantage of sharing in the results of all its departments should belong to every member. Thus the policy of our National Academy of avoiding division into separate sections,[4] and of bringing papers on the most diverse subjects before the entire body, is fundamentally sound and should be maintained. Later in this paper the question will be considered whether the range of the Academy's activities should be extended so as to give increased recognition to departments of knowledge other than the physical and natural sciences.

Under the conditions now existing in the United States, there is reason to believe that the functions of a National Academy might well be multiplied so as to meet a wide variety of needs. It should stand, first of all, as a leading source and supporter of original research and as the national representative of the great body of American investigators in science. To the government it should make itself necessary by the high standard of its work, the broad range of its endeavors, and the sane and scientific spirit underlying all of its actions. To its members it should offer stimulus and encouragement in their investigations; due recognition of their advances; financial assistance and the use of instruments at critical periods in their work; the advantage of listening to papers ranging over the whole field of science, bearing suggestions of principles or methods likely to develop new ideas; contact with the greatest leaders of research from all countries and opportunities to listen to descriptions of their work; access to books and manuscripts not easily obtainable from other sources; and participation in international cooperative projects in every field of investigation. In the public mind it should rank as the national exponent of science, and as the agency best qualified to bring forward and illustrate the latest advances of its own members and of the scientific world at large. To representatives of manufactures and industries, the Academy should serve to promote the appreciation and widespread use of the scientific principles and methods which have built up the great industrial prosperity of Germany. With other societies devoted to various branches of science, it should cooperate in harmony with the best interests of American research. Toward local bodies for the encouragement of investigation and the diffusion of knowledge, it should act as an inspiring example and a reliable source of support. And in the broad field of international cooperation, it should unite with the leading academies of the world in the endeavor to perfect the organization of research and in the use of all agencies contributing to its advancement.

[4] Except for voting purposes.

NEEDS OF THE ACADEMY

Many of these objects have been accomplished by the National Academy in the past, but others remain for the future. The greatest aid in accomplishing its full work would be met by the provision of a suitable academy building, and an endowment sufficient to publish *Proceedings,* conduct research, provide public lectures, maintain exhibits illustrating current investigations, and to meet such additional needs as are implied by the Academy's national charter and its obligations to the scientific world and the general public. Through the courtesy of the Smithsonian Institution, extended in the year of the academy's organization, the annual meetings are held in the National Museum, in rooms ordinarily employed for other purposes. Thus the Academy does not even possess a permanent office, or a room for its library, which will

be needed in the future for its work of research. It has therefore been compelled from the outset to decline many offers of books, and thus a large and valuable collection, comprising publications offered by many of the great academies, laboratories and observatories of the world, has been lost.[5]

It is difficult to overestimate the value of a suitable building in commanding public appreciation and support for any institution. Visible evidence of the Academy's existence is a matter of no small importance, when it is remembered that the average American citizen, though well-acquainted with the name of the Paris Academy through press reports of discoveries announced there, has never heard of our own national organization. But a building used as a storehouse and occupied but once a year is not enough. The Academy must be known as a living and active body, which recognizes and fulfills its many duties to science and the public. If its headquarters were constantly employed for such purposes as are enumerated later, the Academy would soon be looked upon as the natural source of information regarding the latest developments of science, and more generally recognized as the national representative of American research.

IMPORTANCE OF PUBLISHING PROCEEDINGS

As explained in a previous paper, the name of the National Academy has never been associated with the work of its members, since the papers read at its meetings have not been published by the Academy. Thus it has not been sufficiently identified with the progress of American research, and the chief source of the reputation of the Paris Academy and the Royal Society has been lacking. But though the Academy would become more widely known by the publication of *Proceedings,* it would be foolish to take such a step merely to accomplish this purpose. The establishment of a new journal, in these days when the literature of science has become exceedingly complex, should never be undertaken without serious consideration of its probable usefulness. If it fulfills no good and lasting purpose, its life will be deservedly short. Hence we may not imitate the example of societies which established their publications before the special journals had taken the field. We must recognize, on the one hand, that the various journals devoted to particular branches of science meet a clearly defined need and should not be rivaled, even to the apparent advantage of the Academy. On the other hand, we must also remember that the members of the Academy have adopted a regular plan of publication, the interruption of which might interfere with the accessibility of their papers. Thus, if *Proceedings* are to be established, they should be so planned as to serve a useful scientific end and be distinctly advantageous, not merely to the Academy itself, but to all of its members.

I am strongly of the opinion that no step which can be taken at the present time would be so beneficial to the National Academy as the publication of *Proceedings* containing the first announcements of important advances and the chief results of American research. I believe, furthermore, that this can be done in such a way as to benefit the members and contribute to the advancement of science. In many departments of the Academy's work papers published in the special American journals of limited foreign circulation do not reach a sufficiently large group of European readers. I am told that this is

[5] The Academy has accepted some gifts of books, which are packed away (unbound) in the storerooms of the Smithsonian Institution.

particularly true in biology, where American investigators are producing a great body of results of the first importance. Thus the *Proceedings* of the Academy, if properly distributed, might be made to serve the very useful purpose of bringing the work of a large number of investigators to the attention of scholars abroad. But in order to preserve all interests, and to interfere in the least degree with present plans of publication, the *Proceedings* should not be designed to occupy such a place as the special journals adequately fill.

[The chief advantage of the *Proceedings* would not be the same in all departments of science. In mathematics, where the existing journals are greatly overcrowded, prompt publication of the condensed results of new research would be heartily welcomed. The same thing is true in botany and in many other subjects. In fact, improved means of prompt publication would be generally appreciated by Academy members. In biology, as already remarked, the great number of special journals prevents many of them from reaching European laboratories, where American research is frequently overlooked as a consequence. In astronomy and astrophysics, which have fewer journals, the circulation of the chief American journals is large, and their contents reach all investigators abroad. But the practise of publishing separate series of circulars or bulletins, which has been adopted by many American observatories, confines the circulation of their papers to the limited number of astronomers and observatories on their mailing lists. If brief accounts of the broader aspects of these investigations were printed by the Academy, they would be useful to astronomers making a general survey of progress in their own field. But they would be even more serviceable to the mathematician, physicist, meteorologist, chemist, geologist or other investigator who may find information of direct or suggestive value in the results of astronomical research. Conversely, even those astronomers who keep in touch with progress in mathematics or physics can not also examine the numerous journals of chemistry, geology and other subjects which contain results applicable in their own work. It will thus be seen that the Academy could perform an important service in its special province of correlating knowledge by publishing papers covering the whole range of science.

The value of the *Proceedings* in strengthening the position of American science at home and abroad should not be overlooked. The rapid progress of American research in a single field may be known to the European specialist, but he may not realize that similar advances in other departments have raised American science to a new level. Recognition of this fact is desirable, not for the gratification of national pride, but because the international influence of America in science will grow with its prestige. The combination of effort which the *Proceedings* would represent, and the demonstration they would afford of American activity in research, are factors of real significance in securing that recognition and standing, both at home and abroad, which is needed to accelerate future progress.]

To accomplish the desired result, it would seem that the *Proceedings* should be intermediate in character between the *Comptes Rendus* of the Paris Academy and the *Proceedings* of the Royal Society. Papers read before the Paris Academy on Monday are printed and issued in the *Comptes Rendus* on the following Saturday—a record for speed which we should not expect to rival. Such accelerated publication, while it doubtless possesses certain advantages, renders impossible that more leisurely

editorial examination which most journals demand. The *Proceedings* of the Royal Society, on the other hand, appear at irregular intervals, and frequently contain long and detailed papers, which with us might better find a place in the special journals. In the case of the National Academy it is doubtful whether publication at shorter intervals than one month is necessary, but the possible advantages of fortnightly publication should be carefully considered.

It goes without saying that papers for the *Proceedings,* while comparatively brief (perhaps averaging from three to five pages), should not be hasty announcements based on inadequate data. On the contrary, the dignity of the National Academy and the best interests of its members demand that only carefully matured conclusions, resulting from prolonged observational or theoretical research, should appear under the Academy's imprint. Measures and other exact data needed to establish these conclusions would be a necessary part of such papers, though long numerical tables, profuse illustrations, and detailed accounts of minor topics should be reserved for publication in the special journals, to which members would continue to contribute as before. The Academy *Proceedings* would thus serve for the first announcement of discoveries and of the more important contributions to research, illustrated by line cuts and occasional halftones in the text, when essential to clearness, but free from unnecessary detail and extensive numerical data. Non-members, as well as members, should be invited to contribute, with the understanding that their papers are to be presented by a member of the Academy, as in the case of the Paris Academy and the Royal Society.[6]

The constitution of the National Academy already provides for the issue of *Proceedings,* as well as *Memoirs* and *Annual Reports.* In fact, as explained in a previous paper, three volumes of *Proceedings* were published, though they did not contain papers presented to the Academy. There is therefore no need of any radical departure requiring amendment of the constitution. In other words, if sufficient funds are available, this very important step toward the development of the Academy can be taken by simple affirmative vote.[7]

The annual volumes of the *Proceedings,* bringing together for the first time the best product of American research, would place the Academy in a clearer light before the academic world. *Annual Reports* and infrequent volumes of *Memoirs* receive scant attention, except from a few specialists, in the libraries of our contemporary societies. But the *Proceedings,* published at regular intervals, and containing a standing notice of the Academy's publications, would aid in making them better known. The quarto *Memoirs,* eleven volumes of which have already appeared, afford an excellent place for extended publication, when the necessity for lengthy tables, numerous plates, or long discussions of data places the manuscript beyond the reach of the special journals. The publication of the *Proceedings* might serve to disclose

[6] The *Proceedings* should be so planned as to interfere in the least possible degree with the *Journal* of the Washington Academy of Sciences, which is a publication similar in character to the one here proposed. As the *Journal* is devoted mainly to work done in Washington, or presented before the various Washington societies (other than the National Academy), no important overlapping of the two publications need be anticipated, especially as members of this Academy have rarely contributed to the *Journal.*

[7] [The Academy voted, at its meeting of November, 1913, to begin the publication of *Proceedings* as soon as arrangements could be perfected. The first number will appear in January, 1915.]

much material worthy of use in the *Memoirs,* and the editorial board should be constantly on the watch for opportunities to extend the *Memoirs* and to render them more serviceable to science.

SCIENCE AND THE PUBLIC

The circulation of the *Proceedings* would necessarily be limited to scholars and scholarly institutions—they could not be expected to reach the general public. Here a difficulty remains to be overcome, since the results of original investigations should certainly be made more generally known and more clearly understood than they are at the present time. The average man of science, after sad experience with the daily press, is usually forced to the conclusion that newspaper publication is synonymous with rank sensationalism. Repeatedly told, and not without justice, that his cloistered wisdom should reach a wider world, he sometimes yields to the persistent demands of a reporter. The outcome is too well known to require telling. Even in the case of a really intelligent and conscientious reporter, who does not distort or exaggerate, the "headline man" may be depended upon to provide a grotesque disguise. A few experiences of this sort suffice for most investigators. They are soon forced to shut out the reporter, and are well pleased when they succeed. Yet they recognize that the exclusion of the public from all contact with their work is neither fair nor desirable. Some way should be found of bridging the gap.

A plan followed in England by the Royal Society, of circulating brief abstracts on the day when a paper is read, which are afterwards published in *Nature* (sometimes in condensed form), is one which we might advantageously imitate. When a paper is accepted by the editorial board for publication in the *Proceedings,* a brief abstract, preferably prepared by the author, should be sent to Science (and perhaps also to *Nature*). At the same time this abstract, or a briefer one in less technical language, might be communicated to the Associated Press. It goes without saying that papers for the *Proceedings* would differ widely in their availability for popular treatment. Probably only a comparatively small proportion of them would contain results suitable for use by the Associated Press, but all would doubtless be published in abstract by Science. Through the Associated Press, and also through certain conservative newspapers and magazines, the Academy could thus bring before the public the actual results of scientific research, as distinguished from the false and distorted conceptions of science which most of our newspapers now disseminate.

LECTURES ON RESEARCH

The plan of publication outlined above is but one of several methods by which the Academy may enlarge its usefulness. Public lectures should also be instituted, primarily for the benefit of the Academy members, but also with the expectation of reaching a larger circle. Here the Academy would do well to study and imitate the Royal Institution of London, where original research and the diffusion of knowledge are combined in a very effective manner. In brilliant addresses, illustrated by lantern slides and experiments, a long line of illustrious speakers, best typified by Faraday, have charmed and enlightened the most distinguished audiences. Many of these speakers, including Davy, Faraday, Tyndall, Dewar, Rayleigh and Thomson, have been drawn from the staff of the Royal Institution. But their English contemporaries, as well as scientific men from all parts of Europe and the United States,

have also been invited to describe their latest advances. The speaker at a "Friday Evening Discourse" is faced by the leaders of English thought and action in many fields. Privileged to select from the large collection of historic instruments accumulated during a century, and even to illustrate his points with the apparatus of Faraday himself, he feels an inspiration that no other platform affords. In such an atmosphere he learns to appreciate the dignity of popular science at its best, and to perceive how the busiest and most successful of present-day physicists can find time to deliver elaborate courses of Christmas lectures to a juvenile audience. These lectures, instituted by Faraday, are now in their eighty-seventh season. Under such topics as "The Chemistry of Flame" they have afforded him and his followers an opportunity to show how simply and beautifully the principles of science can be made to appeal even to young children.[8] The art of the popular lecture should be developed in the United States by the National Academy. Under its auspices, and with the example of the Royal Institution behind him, the lecturer need not fear for his dignity. The Academy would soon find its reward in the increasing appreciation of its work and purposes, the spread of scientific knowledge, and ultimately in larger endowments for research.

As a first step in this direction, the children of the late William Ellery Hale have established a course of lectures in memory of their father. Their object in doing so is twofold. In the first place, it is hoped that the lectures may add to the attractiveness of the Academy meetings, both to the members and the public. Again, it is believed that by a suitable choice of lecturers and topics, the inter-relationship of the various fields of research represented in the Academy, and the light thrown by the methods of investigation or of interpretation employed in one field upon those of another, may be illustrated in an effective way. Moreover, the lectures will afford an opportunity of testing whether the Academy may not further assist in increasing public appreciation of the cultural and the industrial value of science.

[8] The last course of Christmas Juvenile Lectures, on "Alchemy," "Atoms," "Light," "Clouds," "Meteorites" and "Frozen Worlds," was given by Sir James Dewar.

SCIENCE IN EDUCATION

In the Academy of Plato and the Alexandrian Museum the functions of an academy and a university were united, and the work of instruction went hand in hand with the development of new knowledge. The growth of the modern university has now removed from national academies their former work of teaching a body of students, but their opportunity to exert a favorable influence on the educational methods of the nation remains. The Institute of France, as planned by Talleyrand and Condorcet,[9] was to control public instruction and offer courses to advanced students. This was not carried out, but an instance of the same sort is afforded by the Academy of Munich, which has charge of the public instruction of Bavaria.

There is no apparent reason why our own National Academy should have a formal connection with educational institutions. But in harmony with its purpose to advance knowledge in the United States, it should contribute toward the development of the science of education and take advantage of the possibility of increasing public appreciation of the educational value of science.

In a presidential address which excited

[9] See Hippeau, "L'instruction publique en France pendant la révolution," Vol. 1, pp. 115, 228.

great public interest in England, Sir William Huggins emphasized before the Royal Society the importance of science in education.[10] We need not dwell upon his arguments regarding the value of scientific training in developing the power of accurate observation and the habit of correct and cautious reasoning. But a more neglected phase of science in education—its power of awakening and expanding the imaginative faculty—may be referred to in his own words:

> Surely the master-creations of poetry, music, sculpture and painting, alike in mystery and grandeur, can not surpass the natural epics and scenes of the heavens above and of the earth beneath, in their power of firing the imagination, which indeed has taken its most daring and enduring flights under the earlier and simpler conditions of human life, when men lived in closer contact with Nature, and in greater quiet, free from the deadening rush of modern society. Of supreme value is the exercise of the imagination, that lofty faculty of creating and weaving imagery in the mind, and of giving subjective reality to its own creations, which is the source of the initial impulses to human progress and development, to all inspiration in the arts, and to discovery in science.

Of all the teachings of science, the principle of evolution makes by far the strongest appeal to the imagination. Isolated phenomena, however remarkable, acquire a new meaning when seen in its light. Minute details of structure in animals or plants, slight differences of the relative intensity of lines in the spectra of stars, may become of intense interest even to the elementary student if explained as steps in a great process of development. But, after all that has been said and written since the time of Darwin, we fail to take full advantage of our opportunity. Properly presented, a picture of evolution in its broadest aspects would serve better than any other agency to stimulate the imagination, to awaken interest in science, and to demonstrate that its cultural value is in no wise inferior to that of the humanities. To the average student, even physics and chemistry are distinct branches of science, each occupied with its own problems. Astronomy, he knows, concerns itself with the heavenly bodies, botany with plants, zoology with animals. But if he studies these subjects at all, he almost invariably fails to realize their relationship, because no binding principle, like that of evolution, is brought prominently to his attention or, at the best, is restricted in its application to some single organic or inorganic field.

When Humboldt wrote "Cosmos" and Huxley lectured on "A Piece of Chalk" and other subjects, they showed what might be accomplished in picturing the problems of science in a broad way. The National Academy is better qualified than any other body in America to demonstrate what can be done in the same direction with the rich store of knowledge acquired since their time. A course of lectures on evolution, beginning with an account of the constitution of matter, the transformation of the elements, and the electron theory; picturing the heavenly bodies and the structure of the universe, the evolution of stars and planets, and the origin of the earth; outlining the various stages of the earth's history, the formation and changes of its surface features, the beginning and development of plant and animal life; explaining modern biological problems, the study of variation and mutation, and the various theories of organic evolution; summarizing our knowledge of earliest man, his first differentiation from anthropoid ancestors, and the crude origins of civilization; and connecting with our own day by an account of early Oriental peoples, the rise of the Egyptian dynasties, and their influence on modern

[10] Huggins, "The Royal Society," p. 109.

progress: such a course, free from technicalities and unnecessary details, richly illustrated by lantern slides and experiments, and woven together into a clear and homogeneous whole, would serve to give the average student a far broader view of evolution than he now obtains, and leave no doubt in the hearer's mind as to the cultural and imaginative value of science.

The William Ellery Hale lectures will open with a series on evolution, so designed as to be of interest to members of the academy, and at the same time to be intelligible and attractive to the public. At each meeting two lectures will be given by a distinguished European or American investigator, chosen because of his competence to deal with some branch of the subject. The first course of lectures, to be given by Sir Ernest Rutherford at the annual meeting in April, 1914, will deal with the constitution of matter and the evolution of the elements.[11] At the conclusion of this series, which will extend through several years, it is hoped that the lectures may be brought together, in a homogeneous and perhaps somewhat simplified form, into a small volume suitable for use in schools.

The course above outlined will serve to test the question whether the Academy may advantageously enter more extensively into the lecture field. So far as the members of the Academy are concerned, it seems probable that lectures by able American and European investigators would add to the interest of the meetings. But the value of the lectures to the general public can only be determined by experiment. If a suitable building can be obtained, and the success of these lectures is sufficient to warrant it, the foremost investigators, American and foreign, might be invited from time to time throughout the year to describe and illustrate their advances in the lecture-hall of the Academy. This plan is already followed by various American institutions, but the Academy, because of its national character, would be better able to attract the best men and to give their lectures more than local significance. Ample facilities for experimental illustration would also go far toward enhancing the value of the lectures. In short, the example of the Royal Institution should be followed as closely as possible.[12]

[11] [The second course was given at the autumn meeting by Dr. William Wallace Campbell on "Stellar Evolution and the Formation of the Earth."]

INDUSTRIAL RESEARCH

The value of science to the American manufacturer, though no new theme, is capable of wide development at the hands of the National Academy. In a presidential address delivered before the Royal Society in 1902, Sir William Huggins dwelt on the "Supreme Importance of Science to the Industries of the Country, which can be secured only through making Science an Essential Part of all Education." He saw the fruits of English discoveries passing into the hands of Germany, whose universities have so long fostered and spread abroad the spirit of research, and wondered at the apathy of the average British manufacturer toward scientific methods. Huggins, speaking in plain language, pointed to the chief source of weakness—"the too close adherence of our older universities, and through them of our public schools, and all other schools in the country downward, to the traditional methods of teaching of medieval times."[13]

In this country, where the classics do

[12] [It has been suggested by several members that these lectures might be repeated in two or three large cities, in cooperation with local scientific institutions.]

[13] "The Royal Society," p. 29.

not dominate the university system, the task of arousing an adequate appreciation of the enormous benefits which science can render is a far easier one. We must have, first of all, a widespread interest in science and some comprehension of its problems and methods. A general course on evolution, given to all college students, should be of great service as an entering wedge. More students might thus be led to take science courses, while those who specialize in the humanities could gain a better conception of what science means. The rapid development of research in our universities and technical schools promises to influence the faculties of our colleges, where a man's success as a teacher will be materially enhanced if he is also a producer of new knowledge. Thus the future is promising in the educational field.

On the side of our manufacturers, who are eager to adopt the most efficient methods, the outlook is equally favorable, as President Little of the American Chemical Society showed so effectively in his address on "Industrial Research in America."[14] Many great firms are establishing large research laboratories, where problems of all kinds are under investigation. The development within the past few years of Taylor's efficiency system is another indication that the advantages of scientific methods are being grasped and applied in the arts. But the opportunities in this direction are almost endless, and the National Academy would do well to devise ways and means of convincing not only the large manufacturers, but the small manufacturers as well, of the industrial importance of scientific research. Lectures on recent advances in engineering, by European and American leaders, should have a powerful influence if carefully planned and effectively illustrated. Parsons on the steam turbine,[15] Marconi on wireless telegraphy,[15] Goethals on the Panama Canal, would attract large audiences and appeal in published form to a wide public.

But while the advantages resulting from ingenuity and invention and the best practise of engineering should certainly be brought out in the course of lectures I now have in mind, the improvement of manufactured products by research methods, and the potential industrial value of pure science are the points which should be emphasized. We have a long way to go before any single manufacturing firm employs seven hundred qualified chemists, as the combined chemical factories of Elberfeld, Ludwigshafen and Treptow do. The supremacy in this field of Germany, which produced chemicals valued at $3,750,000,000 in 1907, is directly due to the carefully directed research of an army of chemists, who learned the methods of investigation in the universities and technical schools.[16] The Berlin Academy of Sciences has also contributed in an important way to this result, through van't Hoff's investigations of the Stassfurth salt deposits. The recent rapid development of our own chemical industries leads us to hope that similar advances may soon be achieved in the United States. In electrical engineering, at least, we are already making comparable progress.

But the average man of business is much better able to appreciate the value of research directly applied to the improvement of manufactures than to comprehend the more fundamental importance of pure science. We must show how the investigations of Faraday, pursued for the pure love

[14] Science, 38, pp. 643–656, 1913.

[15] Lectures before the Royal Institution, 1911.

[16] In 1910 the Nobel prize for chemistry went to Germany for the sixth time, thus giving to a single country sixty per cent. of all the Nobel prizes for chemistry awarded up to that date.

of truth and apparently of no commercial value, nevertheless laid the foundations of electrical engineering. If we can disseminate such knowledge, which is capable of the easiest demonstration and the most striking illustration, we can multiply the friends of pure science and secure new and larger endowments for physics, chemistry and other fundamental subjects.

[While there can be no doubt of the importance of emphasizing the value of industrial research, the necessity of vigilance in the interests of pure science is shown by the opposite tendency of several recent writers, who measure science solely in terms of its applicability in the arts.

The stimulus of commercial rivalry is doubtless a factor in the rapid progress of our great industrial laboratories, but I doubt if their directors would maintain that all chemical research should be of the industrial kind. Immediate commercial value as a criterion of success will not often point the way to the discovery of fundamental laws, though these are by far the richest source of ultimate achievement, practical as well as theoretical. Modern electrical engineers do not forget the investigations of Faraday and Hertz in pure science, nor do leading industrial chemists overlook the researches of Gibbs, van 't Hoff, and others, which brought them no practical returns, but rendered many modern industries possible. Exclusive attention to industrial research means nothing more or less than the growth of the superstructure at the expense of the foundations. Industrial laboratories are able to offer large salaries and other tempting promises of material advantages, and thus to draw the most promising men from the universities. But while these laboratories should be strongly encouraged, and multiplied to the point where every small manufacturer will realize the value of research methods, this should not be done at the serious expense of pure science. Germany's success on the industrial side is primarily due to her still greater achievements in the university laboratories. The National Academy, by helping to maintain the two phases of American research in stable equilibrium, can perform a service which the truest advocates of applied science will recognize as essential to sound progress.]

GEORGE ELLERY HALE
THE MOUNT WILSON
SOLAR OBSERVATORY

(To be continued)

UNIVERSITY REGISTRATION STATISTICS

THE registration returns for November 1, 1914, of thirty of the universities of the country will be found tabulated on a following page. These statistics show *only* the registration in the universities considered. There is no intention to convey the idea that these universities are the thirty largest universities in the country, nor that they are necessarily the leading institutions.

The largest gains in terms of student units, including the summer attendance, but making due allowance by deduction for the summer-session students who returned for instruction in the fall, were registered by Columbia (1,365), California (1,109), Pittsburgh (1,069), Ohio State (832), Wisconsin (806), Harvard (784), New York University (634), Minnesota (552), Pennsylvania (536), Illinois (405), Nebraska (349), Cornell (327), Cincinnati (319) and Michigan (311).

Last year there was none that showed a gain of more than 1,000 against four this year, and ten institutions showed gains of more than 300 against fourteen of this year. They were: New York University, Illinois, Columbia, Wisconsin, Pennsylvania, California, Iowa, Ohio State, Chicago and Michigan. There is a theory that universities and colleges have larger increases than usual when national economic conditions are bad, that is during

"hard times." The above seems to bear out this theory.

The only university which shows a decrease in the grand total attendance, including the summer-session, is Indiana. Exclusive of the summer-sessions two other universities show a very slight decrease, Tulane and Kansas.

Omitting the summer-sessions the largest gains for 1914 are Pittsburgh (1,069), Ohio State (687), New York University (580), Pennsylvania (431), Wisconsin (424), California (389), Columbia (349), Minnesota (324), Cincinnati (319), Cornell (318), Illinois (302), Nebraska (297), Harvard (239) and Michigan (218).

Two show gains of more than 900. There were none last year. Fourteen show gains of more than 200 as against twelve last year. Of the fourteen, eight are in the west and six in the east.

According to the figures for 1914, the thirty institutions, inclusive of the summer-sessions, rank as follows: Columbia (11,294), California (8,180), Chicago (7,131), Wisconsin (6,696), Pennsylvania (6,505), Harvard (6,411), Michigan (6,319), New York University (6,142), Cornell (5,939), Illinois (5,664), Ohio State (4,943), Minnesota (4,484), Northwestern (4,072), Syracuse (3,913), Missouri (3,385), Texas (3,371), Yale (3,289), Nebraska (3,199), Pittsburgh (2,975), Iowa (2,768), Kansas (2,650), Tulane (2,441), Cincinnati (2,190), Indiana (2,163), Stanford (1,893), Princeton (1,641), Western Reserve (1,523), John Hopkins (1,374), Washington University (1,345), Virginia (902); whereas last year the order was: Columbia, California, Chicago, Michigan, Pennsylvania, Wisconsin, Harvard, Cornell, New York University, Illinois, Ohio State, Minnesota, Northwestern, Syracuse, Yale, Missouri, Texas, Nebraska, Kansas, Iowa, Tulane, Indiana, Pittsburgh, Cincinnati, Stanford, Princeton, Western Reserve, Johns Hopkins, Washington University and Virginia.

A comparison shows that the following seventeen universities hold the same relative positions (indicated by the numerals following the name) as was held last year. Columbia (1), California (2), Chicago (3), Pennsylvania (5), Illinois (10), Ohio State (11), Minnesota (12), Northwestern (13), Syracuse (14), Nebraska (18), Iowa (20), Stanford (25), Princeton (26), Western Reserve (27), Johns Hopkins (28), Washington University (29) and Virginia (30). On the other hand, there are several changes: Wisconsin comes up to fourth place, passing Michigan and Pennsylvania. Harvard advances one place and Michigan is crowded out of fourth to seventh place. Cornell yields eighth place to New York University. The next change shows Missouri and Texas advancing one place each to fifteenth and sixteenth, respectively, and Yale dropping behind them. Next comes Nebraska and then Pittsburgh, which shows the greatest advance, coming all the way from the twenty-third position to the nineteenth. Iowa holds its own at the twentieth place and is followed by Kansas, which has slipped back two notches. Tulane twenty-second this year, and last year twenty-first, is followed by Cincinnati, which has advanced one place, and then by Indiana, which last year held the twenty-second place. The remaining six schools hold the same places held last year.

If the summer-session enrollment be omitted the universities in the table rank in size as follows: Columbia (6,752), Pennsylvania (5,736), California (5,614), Michigan (5,522), New York University (5,415), Harvard (5,161), Illinois (5,137), Cornell (5,078), Wisconsin (4,874), Ohio State (4,395), Northwestern (3,941), Minnesota (3,940), Chicago (3,887), Syracuse (3,739), Yale (3,289), Pittsburgh (2,975), Nebraska (2,779), Missouri (2,682), Iowa (2,449), Texas (2,447), Kansas (2,304), Cincinnati (2,190), Stanford (1,888), Princeton (1,641), Indiana (1,570), Western Reserve (1,523), Washington University (1,345), Tulane (1,223), Johns Hopkins (1,058), Virginia (902); whereas last year the order was: Columbia, Pennsylvania, Michigan, California, Harvard, Illinois, New York University, Cornell, Wisconsin, Northwestern, Chicago, Ohio State, Syracuse, Minnesota, Yale, Missouri, Nebraska, Texas, Kansas, Iowa, Pittsburgh, Cincinnati, Stanford, Princeton,

Indiana, Western Reserve, Tulane, Washington University, Johns Hopkins and Virginia.

This comparison shows that the relative positions of thirteen of the universities remain unchanged, although only in the case of one institution, Pittsburgh, is the change of more than passing interest. The others shift about as follows: Michigan yields to California, while New York University passes Harvard and Illinois. Northwestern and Chicago now follow Ohio State instead of preceding it as in the past. Minnesota passes Chicago and Syracuse, and the latter is followed by Yale. Pittsburgh leaps to the sixteenth position, passing Missouri, Nebraska, Texas, Kansas and Iowa. Nebraska and Missouri exchange places and Iowa goes ahead of Texas and Kansas. The remaining schools hold the same relative positions with the exception of Washington University and Tulane, which change about.

While on the subject of the change in the relative positions of the universities, based on their registration statistics, it may be of some interest to briefly point out the change in 1914 from the positions held in 1904.

At that time the twenty-seven institutions then considered, inclusive of the summer-session, ranked as follows:

1. Harvard.
2. Columbia.
3. Chicago.
4. Michigan.
5. Minnesota.
6. Cornell.
7. California.
8. Wisconsin.
9. Illinois.
10. Pennsylvania.
11. Yale.
12. Northwestern.
13. Nebraska.
14. Syracuse.
15. New York University.
16. Ohio State.
17. Missouri.
18. Iowa State.
19. Kansas.
20. Stanford.
21. Princeton.
22. Indiana.
23. Tulane.
24. Texas.
25. Western Reserve.
26. Johns Hopkins.
27. Virginia.

Comparing this ranking with that of 1914 shown above, it should be noted that generally speaking the relative positions of the universities have changed but little. By dividing all of the universities considered in 1904 into three equal groups, and by comparing these groups with a similar grouping for 1914, it will be seen that each group has a tendency to hold its membership; in other words, universities in group I. in 1904 are almost certain to be found in group I. in 1914, those in group II. in 1904 are almost certain to be found in group II. in 1914, and those in group III. in 1904 are almost certain to be found in group III. in 1914. There are, however, several exceptions to this rule. Minnesota ten years ago occupied fifth position in group I. and is now occupying twelfth position, or the second position in group II. Pennsylvania headed the second group ten years ago and is now occupying fifth position in the first group. New York University has changed from the fifteenth position to the eighth, that is, from the second group to the first, in the same period. The only other change is that of Texas from the third to the second group.

Changes in the position of the universities within each group are not considerable. Harvard holding the ranking position ten years ago, now has the sixth place, whereas Columbia has taken the lead, with California following. Michigan has gone from the fourth to the seventh position. Yale has dropped from the eleventh to the seventeenth position, and Ohio State has advanced into its place, and Nebraska has dropped back from the thirteenth to the eighteenth position. There are no decided changes in the third group. All of which suggests the conclusion that the increase in attendance of these universities tends to be proportionately equal. This may be discussed more fully in another article.

Including the summer session attendance, the largest gains in the decade from 1904 to 1914 were made by Columbia (6,461), California (4,442), New York University (3,762), Pennsylvania (3,477), Wisconsin (3,326), Ohio State (3,185), Chicago (3,096), Texas (2,441), Michigan (2,319), Illinois (2,295), Cornell (2,106).

Considering, now, the individual schools of the various universities, California with 1,238 men and 1,853 women, leads in the number of college undergraduates, being followed by Harvard, with 2,479 men and 603 women (Radcliffe College); Michigan, with 1,802 men

and 780 women; Wisconsin, with 871 men and 874 women; Columbia, with 1,014 men and 689 women; Chicago, with 911 men and 746 women; Minnesota, with 816 men and 905 women; Texas, with 817 men and 651 women; Yale, with 1,437 men; Kansas, with 776 men and 626 women; Nebraska, with 650 men and 761 women; Missouri, with 829 men and 562 women; Syracuse, with 1,330 men and women; Princeton, with 1,327 men; Indiana, with 778 men and 461 women; Cornell, with 926 men and 279 women, and Northwestern, with 522 men and 653 women. In the scientific schools, that is the schools of engineering, Illinois takes the lead with 1,406 students, followed by Cornell with 1,363, Michigan with 1,347, Yale with 1,056, Pennsylvania with 906, Ohio State with 851, Wisconsin with 796, California with 763, Minnesota with 590, Columbia with 461, Cincinnati with 458, Kansas with 427, and Stanford with 418; and in the law schools Harvard takes the lead with 716 students, followed by New York University with 715, Michigan with 499, Columbia with 440, Pennsylvania with 356, Texas with 343 and Northwestern with 336.

The largest medical school is now in the east at New York University where 439 students are registered in this subject. Michigan follows with 378 students, Johns Hopkins with 374, Columbia with 358, Tulane with 343, Harvard with 321, Pennsylvania with 290, Illinois with 287 and Ohio State with 281. Columbia has the largest non-professional graduate school with 1,689 students, far outnumbering Chicago with 598, Harvard with 512, Pennsylvania with 489, California with 478, New York University with 376, Yale with 371, Illinois with 340 and Cornell and Wisconsin with 321 each. Cornell holds the lead in agriculture with 1,535 students, followed by Wisconsin with 1,091, Ohio State with 973 and Illinois with 959. Four of the universities report courses in architecture. Of these Cornell is the leader with 157 students in this branch, followed by Michigan with 145, Columbia with 110 and California with 16. Harvard, Illinois, Kansas, Minnesota, Ohio State, Pennsylvania, Syracuse, Texas, Tulane and Washington University have registered students in architecture, but listed in other departments. In art Syracuse leads with 150 students and is followed by Washington University. Although courses in art are given at California, Iowa State, Michigan and Northwestern, the students are counted in other departments.

With 2,466 students New York University's School of Commerce is in the lead, numerically speaking; Pennsylvania has the next largest with 1,615 students; following comes Pittsburgh with 790, Northwestern with 645, Wisconsin with 469, Illinois with 376 and California with 287. In this connection it may be of interest to note that the largest school is in the east and that the schools succeed each other in numbers following their geographical location toward the west. In dentistry Pennsylvania holds the lead with 663 students, followed by Northwestern with 578, Michigan with 318 and Iowa State with 302. Of the four divinity schools, Northwestern continues leader with 216 students, as against Chicago's 152, Yale's 112 and Harvard's 59. Syracuse's School of Forestry attracts 242 students this year, Nebraska 43, Yale and Minnesota 37 each. With 136 students in journalism Columbia leads, followed by New York University with 110, Wisconsin with 101, Missouri with 76 and Indiana with 67. Syracuse has 960 music students, and is followed by Northwestern with 400 and Indiana with 100. Columbia has by far the largest school of education, enrolling 1,817 students as compared with Pittsburgh's 668, New York University's 383, Syracuse's 343 and Ohio State's 341. The largest school of pharmacy is at Columbia where 495 students are enrolled. With 200 students Pittsburgh follows and then comes Illinois with 199, Western Reserve with 120 and Michigan with 110. There are only four universities on the list teaching veterinary medicine. These are Ohio State with 182 students, Pennsylvania with 122, Cornell with 116 and New York University with 15.

All of the above figures are for the individual schools and are exclusive of the sum-

mer-session attendance. The largest summer-session in 1914 was at Columbia, where 5,590 students were enrolled, as against 3,983 at Chicago, 3,179 at California, 2,602 at Wisconsin, 1,594 at Michigan, 1,436 at Cornell, 1,250 at Harvard, 1,218 at Tulane and 1,205 at Texas.

Of the 145 students in architecture at the University of California the 16 students listed are graduates only. There are besides 129 who are undergraduates in the college and these are included in the college statistics. In art are registered 213 students but these are included in extension and similar courses. The 936 students in education are included in the college statistics. Forestry and veterinary medicine are included in the School of Agriculture, and music in the College of Liberal Arts. The extension courses show the following registration: San Francisco Institute of Art, 213; Wilmerding School of Industrial Art, 145; University Farm School, Davis, 267; short courses in agriculture, 170; correspondence, 1,996; correspondence work in the state prisons, 153; class work, 538; and class work in state prisons, 608.

Under other courses are listed at the University of Chicago 881 students, all of whom are taking work in regular university classes meeting Saturday morning and late in the afternoon of the other week days. These classes are given primarily for teachers who are working for baccalaureate and for advanced degrees.

At the University of Cincinnati a school of household arts of college grade was opened this year. An advance in entrance requirements to the Medical College has reduced the classes for several years but the turn of the tide has commenced and the entering class this year is larger than that of recent years.

Of the 1,817 students classified under education at Columbia University 921 are in the School of Education and 896 in the School of Practical Arts. The decrease in the number of students in the Schools of Mines, Engineering and Chemistry is caused by the fact that these schools have been placed on a graduate basis. Students are now required to hold a bachelor's degree or the equivalent, including several elementary courses in the sciences.

At Cornell University 534 registered in the winter course in agriculture are listed under extension courses.

The Graduate School of Applied Science at Harvard University is in a state of transition, owing to the cooperative plan with Massachusetts Institute of Technology.

Of the 379 registered in other courses at the University of Illinois, 333 are registered under household science and 46 under library economy.

The total attendance at the University of Iowa, including all departments but excluding the summer-session, is divided into 1,706 men and 797 women.

Of the 374 in the School of Medicine at Johns Hopkins University 361 are registered for the degree of Doctor of Medicine and 13 are taking special courses for physicians. There are 170 students registered in the college courses for teachers given in the afternoons. The department of engineering is only in its third year and all but a small number, that is the third year men, are pursuing courses in the undergraduate college. No record is made this year of the number.

There are 154 students registered in education at the University of Kansas, but all but one of these are listed in other schools of the university.

Of the 1,492 students in the Scientific Schools in the University of Michigan, 1,347 are in engineering and 145 in architecture. The 535 officers include 30 non-resident lecturers and summer-session appointees for the college, 128 graduate assistants, and 23 administrative officials not included elsewhere.

The registrations at the University of Minnesota are incomplete, due to the fact that the short courses, particularly in agriculture. have not been started. These registrations will increase the total mentioned under extension and similar courses.

The figures for the University of Missouri include the enrollment in all schools at Columbia and in the Schools of Mines and Metallurgy at Rollo. The School of Commerce,

which was organized last spring and requires two years of college work for admission, has an enrollment of 12. The decrease in the enrollment of the scientific schools is due to an increase in the admission requirements, since 1911, to two years of college work. Forestry is given in the College of Agriculture.

Of the 282 students in other courses at Northwestern University 110 are enrolled in courses for nurses, and 172 in the School of Oratory. The summer-session in arts was reorganized and the increase the last year was 30 per cent. The Law School is enjoying the largest registration in its history despite the fact that this year the entrance requirements were increased to one year of college work for those twenty years of age and under. The School of Pharmacy has raised its requirements from one year of high school to high school graduation and this increase has cut down the registration from more than 200 in former years to 74 this year. After three years of steady decrease, due to the increase in requirements, the medical school registration shows an increase. The freshman class this year was 83 per cent. larger than that of last year.

Of the 463 men registered in the college of New York University 298 are in the College of Arts and 165 in Washington Square College. The course in journalism is included in the School of Commerce. Under other courses is listed the woman's law class with an enrollment of 50.

This year for the first time the registration statistics of Ohio State University include the enrollment in dentistry and medicine. The latter includes homeopathic medicine. Home economics mentioned under other courses has a registration of 234 and optometrics has a registration of 9.

The University of Pennsyvania, which now enters on its 175th year, shows in the Dental School an enrollment of 663 students, the largest in the history of the school. The School of Education has begun a separate existence with an enrollment of 89, and the Law School shows a decrease of 25. This is the last year for admission to this school without the B.A. degree or its equivalent. The Medical School, which in former years has suffered losses due to the gradual annual increase in the admission requirements, for the first time in seven years shows an increase. There is a slight increase in the department of mechanical and electrical engineering, now separate schools of engineering. The extension courses given at Wilkes-Barre, Scranton, Harrisburg and Reading have a total registration of 564. The Wharton School of Finance enrolls its largest freshman class this year, but, on the other hand, the School of Veterinary Medicine shows a loss because of an increase in the admission requirements to two years of high school work. In the medical and dental departments women have been admitted this year for the first time, three and two respectively being registered. The 743 students in other courses are divided between the college courses for teachers with an enrollment of 727, and courses in hygiene with 16.

The large increase in the University of Pittsburgh is due in part to the improved methods of publicity employed by the university, but mostly to the increase in public interest caused by the general campaign for funds last winter. Of the 304 students in engineering, 226 are registered in the School of Engineering, and 78 in the School of Mines.

Of the 198 students enrolled in other courses at Syracuse University 50 are regular students in architecture, and 63 in *belles lettres*, 20 in photography, and 65 in the School of Oratory. The latter was established last year with a four-year course. The decrease in the College of Law was due to the increase in entrance requirements, which ask now one year of regular college work. Twenty students listed under extension courses took work in the short winter course in agriculture. In connection with New York State College of Forestry of Syracuse University, a forest ranger school is maintained.

The 44 students under other courses at the University of Texas are students in the School for Nurses.

At Tulane University of Louisiana there may be some duplications between the summer-

	California	Chicago	Cincinnati	Columbia	Cornell	Harvard (Inc. Radcliffe)	Illinois	Indiana	Iowa State	Johns Hopkins	Kansas	Michigan	Minnesota	Missouri	Nebraska	New York University	Northwestern	Ohio State	Pennsylvania	Pittsburgh	Princeton	Stanford	Syracuse	Texas	Tulane	Virginia	Washington University	Western Reserve	Wisconsin	Yale
College, Men	1238	911	247	1014	926	2479	505	778	1358	294	776	1802	816	829	650	463	522	610	438	411	1327	663	1330	817	162	415	173	434	871	1437
College, Women	1853	746	491	689	279	603	426	461		....	626	780	905	562	761	247	653	389	18	160	....	427		651	197	...	220	416	874	....
Scientific Schools*	763	....	458	461	1363	120	1406	295	240	†	427	1347	590	334	299	261	84	851	906	304	139	418	300	275	149	94	211	....	796	1056
Law	134	213	....	440	235	716	112	77	191	....	142	499	171	100	193	715	336	206	356	154	....	177	255	343	83	256	103	96	168	142
Medicine	128	200	80	358	151	321	287	149	144	374	51	378	213	75	156	439	196	281	290	107	....	73	99	185	343	107	78	174	96	50
Non-professional grad. schools	478	598	138	1689	321	512	340	105	115	230	104	258	169	163	190	376	107	165	489	43	175	130	130	75	18	42	45	17	321	371
Agriculture	540	....	....	.....	1535	....	959	....	.....	.....	.....	....	598	536	436	....	....	973	....	....	....	....	101	56	....	....	....	....	1091	....
Architecture	16	....	....	110	157	†	†	....	.....	....	†	145	†	....	....	....	....	†	†	....	....	....	†	†	†	...	†	....	....	....
Art	†	....	8	....	....	....	....	59	†	....	19	†	....	....	67	....	†	....	....	....	....	....	150	....	53	...	142	....	....	38
Commerce	287	170	180	.....	....	147	376	....	†	....	....	†	....	12	150	2466	645	....	1615	790	....	....	.....	74	112	....	....	....	469	....
Dentistry	112	....	....	....	....	204	84	....	302	....	....	318	253	....	....	....	578	126	663	227	....	....	.....	....	61	...	110	164	....	....
Divinity	....	152	....	....	....	59	....	....	.....	.....	.....	....	....	....	....	....	216	....	....	....	....	....	.....	....	....	....	....	....	....	112
Forestry	....	....	....	....	....	....	....	....	.....	.....	....	†	37	†	43	†	....	†	....	....	....	....	242	....	....	....	....	....	....	37
Journalism	....	....	....	136	....	....	†	67	.....	.....	....	†	....	76	....	110	....	†	....	....	....	....	.....	31	11	....	....	....	101	....
Music	†	....	....	3	....	....	68	100	.....	.....	94	†	†	....	....	....	400	....	32	....	....	....	960	84	16	....	....	....	84	82
Pedagogy	†	262	224	1817	....	....	....	210	†	....	1	†	94	189	196	383	....	341	89	668	....	....	343	421	85	....	....	....	46	....
Pharmacy	95	....	....	495	....	....	199	....	62	....	64	110	97	....	23	....	74	77	....	200	....	....	.....	57	8	....	....	120	32	....
Veterinary Medicine	....	....	....	.....	116	....	....	....	.....	.....	....	....	....	....	....	15	....	182	122	....	....	....	.....	....	....	....	....	....	....	....
Other Courses	....	881	561	.....	....	....	379	8	91	160	....	....	15	....	....	50	282	243	743	....	....	....	263	44	....	...	308	134	41	....
Deduct Double Registration	30	246	197	460	5	....	4	739	54	....	....	115	18	194	385	110	152	49	25	89	....	....	434	666	75	12	45	32	116	36
Total	5614	3887	2190	6752	5078	5161	5137	1570	2449	1058	2304	5522	3940	2682	2779	5415	3941	4395	5736	2975	1641	1888	3739	2447	1223	902	1345	1523	4874	3289
Summer Session 1914	3179	3983	....	5590	1436	1250	938	855	489	356	562	1594	867	956	606	938	245	926	983	....	....	14	296	1205	1218	‡	....	....	2602	....
Deduct Double Registration	613	739	....	1048	575	....	411	262	170	40	216	797	323	253	186	211	114	392	215	....	....	9	122	281	....	....	....	....	780	....
Grand Total 1914	8180	7131	2190	11294	5939	6411	5664	2163	2768	1374	2650	6319	4484	3385	3199	6142	4072	4943	6504	2975	1641	1893	3913	3371	2441	902	1345	1523	6696	3289
Grand Total 1913	7071	6834	1871	9929	5612	5627	5259	2271	2542	1311	2610	6008	3932	3135	2850	5508	3877	4111	5968	1906	1599	1756	3845	3106	2298	885	1225	1370	5890	3263
Grand Total 1911	6051	5914	1423	8642	6041	5511	5217	2418	2081	1075	2448	5977	4783	2780	2877	4178	3481	3877	5400	....	1543	1684	3408	2669	2128	804	1133	1331	5492	3224
Grand Total 1909	4084	5487	1372	6132	5028	5558	4502	2231	2246	710	2144	5259	4351	2589	3402	3843	3197	3012	4857	....	1398	1620	3248	2492	1882	767	964	1083	4245	3276
Grand Total 1904	3738	4035	767	4833	3833	5392	3369	1206	1460	740	1446	4000	3886	1704	2728	2380	2856	1758	3027	....	1385	1424	2452	930	1124	691	912	808	3370	3008
Extension and Similar Courses	4090	....	262	3841	534	10	....	296	.....	....	313	309	830	210	775	1668	110	37	564	212	....	....	20	1072	47	...	....	....	3296	....
Officers	604	....	....	951	....	803	626	125	275	247	....	536	....	306	283	450	....	423	....	....	220	349	300	294	339	99	206	255	696	....

* Includes Schools of Mines, Engineering, Chemistry and related subjects. † Included elsewhere. ‡ 1375 with 41 double registrations.

session enrollment and that of the regular term. These, however, were not recorded. The grand total, therefore, may not be comparable with the totals of other universities.

The 211 students in the scientific schools of Washington University are divided between courses in engineering and architecture, while 37 of the students in other courses are enrolled in the department of social economy and the remainder, 271, are enrolled in the Saturday courses for teachers.

Courses for teachers are offered this year in Western Reserve University, and 92 teachers in the public schools of Cleveland are enrolled. There are six students taking one class in the College for Women in connection with work in the Cleveland Art School. These are not included in the statistics.

The non-resident fee of the University of Wisconsin was increased from $70 to $100 a year, taking effect for the first time this fall. Despite this increase the total registration exclusive of the summer-session enrollment is 4,874 as against 4,450 last year.

The Yale University statistics in art do not include 86 enrolled in other departments. Of the 371 in the Graduate School, 89 are taking special teachers' courses. There are 67 students enrolled in other departments not included in the statistics for music. Yale University has no summer-session except for the regular summer work done in connection with certain classes in forestry and engineering. The principal changes in registration from last year are the increase in the College, School of Religion, Law School, and the decrease in the School of Fine Arts and the Sheffield Scientific School. In the School of Fine Arts the decrease is due to the new admission requirements and in the Sheffield School is due partially to the increase in tuition fees.

John C. Burg
Northwestern University

Charles Sedgwick Minot, December 23, 1852–November 19, 1914

The passing of a man like Minot leaves us, his friends, sad and filled with sorrow that so significant a life should be thus swiftly ended. One feels as when he hears of some vanishing form—that just such a creature can hardly come again, for the personality of the unusual man is no less unique and he does not reappear. Yet so long as those who knew Minot live, so long as what he planned and thought persists to mould the purposes of those who follow, so long will his power stretch like the wave that seems to fade but really is extended.

Perhaps Minot was intimate with some men who were his seniors; I doubt not Henry Bowditch was his confidant, but among his contemporaries he seldom showed his thoughts or his emotions in the making. Such intimacies he did not cultivate.

Careful and scrupulous, even in the minor ways of life, the impression which he left was of a man always sensitive to his surroundings —keenly alive to the interests of the greater world, seeing life largely, but ever fastidious and fine in the formulation of the thoughts that occupied his active mind. All life for him was purposeful and very interesting. Few men, upon occasion, could speak more aptly in appreciation of a scientific friend.

Well balanced gifts of a high order, a sound training, stimulating social contacts and ample means were his. As one looks back over the past thirty-five years, Minot is to be found among the first movers in each effort for biological advance: everywhere he took part both with insight and with foresight. The beginnings of the Society of Naturalists —that first effort to bring the working biologists of the newer school together—find him in the van. The American Association for the Advancement of Science, the Marine Biological Laboratory are both indebted to him, and his administration of the Elizabeth Thompson fund remains a model of aid to the efficient.

The honors that belong to such a man came to him generously and steadily yet were always somehow transmuted into public service for the biological world. His European training in the early years included study in the never-to-be-forgotten laboratory of Carl Ludwig, and work with that solitary master, Ran-

vier—great teachers both, who left their impress.

Devoted to the study of structure, he yet maintained, by reason of his early training and the later contacts with Henry Bowditch, a lively interest in the broader problems of physiology; problems which must ever face the serious student of structure. He was first among us systematically to examine the phenomenon of growth after birth, and those who know anything of his history are familiar with the tragedy whereby in a night his whole colony of guinea-pigs, which he had followed in their growth with unremitting care for several years, and which he planned to make the basis of a life-long study, was utterly destroyed. This was a blow that only those who have suffered from some form of sudden and irreparable loss of their labors can appreciate, and it left him for the moment stunned. It was then that he plunged into his embryological work and produced his masterly book on human embryology, accompanying it by the enlargement of that collection of complete series of embryological sections which became so great a feature of his laboratory, and of which he was so justly proud. But the older interest never died, and many who hardly knew the earlier man learned to know him through his last book on "Age, Growth and Death," in which he brought together in his lucid way his work and comments on this fascinating theme.

As a teacher he will long be remembered as the man who made those with eyes to see. Most of us would like our epitaph to run that way; it stands for lasting work.

When we move one side to get the larger view of his activity, it is startling to suddenly recognize that this work of his in histology and embryology—work which started with the beginnings of such things in this country—was conducted in a medical school. I must confess that personally I was always impressed by this. Of course it was as it should be, but how seldom do such things occur. With Minot you were in the realm of pure science, whether you found him in his little dormer room on Bolyston street or in his marble hall of to-day. The technical atmosphere did not enter in; it was always the scientific interest that you felt. Men have worked with him, often I am sure, almost without remembering that his laboratory was counted as part of a professional school. To have achieved such detachment, while doing full justice to those who came to him for professional training only, was a great art, and betokens an unusual man. The teacher of histology to Harvard medical students was a one time president of the American Association for the Advancement of Science, president of the Boston Society of Natural History and recently exchange professor at Berlin. Fortunate the students who had such a teacher, for the qualities of the man went into his instruction.

To dwell upon the man—the man as a force—has been the purpose of these few words, and perchance the better one knew Minot the more the words will mean. At these Christmas meetings, where he was so well known, we shall miss our friend with his clear speech, sure hand in the conduct of affairs and ready, generous interest in each youthful searcher after truth—and we shall remember him.

HENRY H. DONALDSON

December 19, 1914

SAMUEL FRANKLIN EMMONS MEMORIAL FELLOWSHIP

THE friends of the late Dr. Samuel Franklin Emmons have established a fund whose income may be used in support of a fellowship to promote investigations in the branches of geology which were cultivated by him, more especially on the economic side. The funds have been placed in charge of the trustees of Columbia University, but the choice of the fellow and the expenditure of the income are entrusted to a committee consisting of Professors James F. Kemp, John D. Irving and Waldemar Lindgren. The committee announces that it will be prepared to award in March, 1915, a fellowship of $1,000 for the year July 1, 1915 to June 30, 1916, inclusive. Applications must be made on blanks which will be furnished by the secretary of Colum-

bia University, New York, N. Y., and which when filled and accompanied by testimonials and complete statements of the applicant's qualifications will be submitted by him to the committee on March 1, 1915. Applications must be received by the secretary of Columbia University before this date.

The committee requires that applicants should be qualified by proper geological training and experience to undertake the investigation of some problem in or related to economic geology. Each candidate is expected to submit with his application a definite statement of the problem which he proposes to study. The carrying out of the investigation will be under the oversight of the committee and may be undertaken at any place or institution which may be preferred by the holder of the fellowship and which will meet the approval of the committee. The place and publication of results will be decided by the committee. The committee will require that the holder of the fellowship agree to give his entire time and energies to the problem selected, and further agree to contract no other engagements conflicting with or restricting this work without its consent. No objection will be made to the use of the results as a dissertation for the degree of Ph.D. in an approved university.

THE SAN FRANCISCO MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

At the meeting of the American Association which will be held in San Francisco and vicinity during the week beginning August 2, 1915, the general appointments of the convocation week will be as follows: The opening session at 10:00 A.M., Monday, August 2, the presidential address and the reception to visiting scientists on Monday evening and four addresses before the association as a whole. The first of these addresses will be given on Tuesday evening by Dr. Fridtjof Nansen, of Norway, upon oceanographic research. On Thursday evening, Professor R. A. Daly, of Harvard University, will present an address upon problems of geologic and biologic interest centering in the Pacific Islands. On Friday evening, Professor W. B. Scott, of Princeton University, will present an address upon the paleontologic relations of North and South America. A final address will be provided for Saturday evening, August 7, upon issues concerning the peoples of the Pacific area.

These general addresses will be given in San Francisco. The section and society meetings will be held on Wednesday, August 5, at Stanford University, and on the remaining days of the week at the University of California in Berkeley.

The geological sessions will be in charge of the Geological Society of America and will be devoted to discussions of erosion and deposition in arid climates, diastrophism of the Pacific coast and petrological problems of the Pacific area. The topics of the meetings of the Paleontological Society include a discussion of the fundamental criteria used in determining the time relations of widely separated life assemblages and rock systems, followed by three symposia upon the special problems encountered in correlation of the Triassic, Cretaceous and Miocene of the Pacific coast with horizons referred to these periods in other parts of the world. Special papers on other topics of interest will be presented.

Zoological sessions are being planned for the discussion of general problems of zoology, evolution and development, of regulation, of geographic distribution, of marine biology, the conservation of wild life, and recent advances in the field of protozoology.

The opening session of the botanical meetings will be devoted to the taxonomy, morphology, history and distribution of Gymnosperms. Subjects discussed at other sessions will be the effects of light upon plants, the geographic distribution of plants with especial reference to the possible origin of the California flora, and marine and fresh-water Algæ.

The subjects of the anthropological meetings will be: Races in the Pacific area with reference to the origin of the American Indians; the history of civilization in the Pacific area, with reference to the relations be-

tween Asia and the New World: and the social aspects of race factors in the Pacific area.

Two general topics will be considered in the agricultural sessions: The relation of agriculture to the food supply of the country, and problems of agricultural conservation. In the treatment of these topics sessions will be devoted to problems of animal production, nutrition, agronomy, soil analysis, general problems of agricultural chemistry and progress in horticultural science.

Papers upon any of these subjects are cordially invited from all members of the American Association and of societies participating in these meetings. Contributions of important work in any other lines of research will also be welcomed and will be included in the programs in so far as time will permit.

SCIENTIFIC NOTES AND NEWS

THE present number of SCIENCE completes the fortieth volume and the twentieth year of the journal under the present editorship. SCIENCE was established in 1883 by Dr. A. Graham Bell and Gardiner G. Hubbard. The president of the board of directors was D. C. Gilman, the vice-president, Simon Newcomb and the editor S. H. Scudder. In 1900 SCIENCE became the official organ of the American Association for the Advancement of Science, and its membership has since increased from 1,721 to over 8,000. The journal has witnessed and to a certain extent assisted the remarkable advance in scientific research which has taken place in America in the course of the past forty years.

AT a joint session of the physiological, biochemical, pharmacological and pathological societies, meeting at St. Louis, on December 28, papers will be presented in memory of S. Weir Mitchell, by Professor Edward T. Reichert, University of Pennsylvania, and of Charles Sedgwick Minot, by Professor Frederic S. Lee, Columbia University.

PROFESSOR EDWARD S. MORSE, director of the Peabody Museum, has been elected president of the Boston Society of Natural History, succeeding the late Professor Charles Sedgwick Minot.

PROFESSOR GEORGE QUINCKE, the distinguished physicist of the University of Heidelberg, has celebrated his eightieth birthday.

DR. JAMES WITHYCOMBE, who was director of the Oregon Agricultural College for nearly fourteen years, will soon enter upon his new duties as governor of Oregon, to which office he was recently elected by an unprecedented majority.

AT the annual meeting of the trustees of the Carnegie Institution of Washington there were elected as trustees Senator Henry Cabot Lodge, of Massachusetts; Dr. George Wharton Pepper, of Philadelphia, formerly professor of law in the University of Pennsylvania; Dr. Theobold Smith, who has resigned the chair of comparative pathology at Harvard University to become a member of the Rockefeller Institute for Medical Research, and Mr. Charles Payne Fenner, of Louisiana. Dr. Simon Flexner, director of the laboratories of the Rockefeller Institute, has resigned as a trustee of the Carnegie Institution.

THE statement regarding the award of the Hayden Memorial gold medal by the Academy of Natural Sciences of Philadelphia, in SCIENCE for December 18 requires a correction. After the modification of the deed of trust in 1900, the first gold medal was given to Sir Archibald Geikie, in 1902, the second to Dr. Charles Walcott in 1905, the third to Dr. John Mason Clarke in 1908, and the fourth to Dr. John Casper Branner in 1911.

AT its last meeting, the Rumford Committee of the American Academy made the following appropriations: For the purchase of a refrigerating apparatus for the academy, the same to be loaned to Professor C. A. Kraus for his research on solutions in liquid ammonia, $300. For the purchase of a motor generator for the academy, the same to be loaned to Dr. H. P. Hollnagel for his research on the extreme infra-red portion of the spectrum, $300.

THE National Society for the Promotion of Industrial Education, at its recent meeting at Richmond, has elected the following officers: *President,* William C. Redfield, secretary of commerce; *Vice-president,* Cheesman A. Herrick, president of Girard College;

Philadelphia; *Treasurer,* Frederick B. Pratt, secretary, Pratt Institute, Brooklyn, N. Y.

Dr. George W. Crile, of the Medical School of Western Reserve University, will leave Cleveland on December 30 for the American Ambulance Hospital, near Paris, to assist in its work.

Dr. Alexis Carrel, of the Rockefeller Institute for Medical Research, is making a study of the French military medical establishments at the front under the auspices of the government.

Dr. Elie Metchnikoff, the eminent Russian pathologist, who for the last twenty-six years has been engaged in research at the Pasteur Institute in Paris, will be seventy years old next year, and a *Festschrift* for him has been in preparation at Paris for this anniversary. The *Journal of the American Medical Association* states that Dr. Emil von Behring, of Marburg, had intended to contribute an article to it, but the breaking out of the war prevented his article reaching the publishers on time, that is before September 1. He now publicly announces (November 12) that he hopes "before the anniversary in question, next May, to manifest in some other way my respect and unwavering friendly sentiments for Metchnikoff on the occasion of his seventieth birthday.

On December 7, Professor C. J. Keyser, who was a guest of the faculty of Washington University at a smoker held at the Faculty Club of that institution, spoke on the demand for advanced avocational instruction and the obligation of universities to provide it. On the following evening he delivered an address on "Science and Religion" under the auspices of the Washington University Association.

Dr. A. G. Worthing, of the Nela Research Laboratory, Cleveland, addressed a meeting of the physics colloquium of the University of Illinois on December 9, on "Optical Pyrometry and some of Its Applications."

Dr. R. Ruggles Gates, of the University of London, lectured before the Washington University Association, St. Louis, in November, on "The Modern Study of Heredity" and "The Present Status of Evolution."

The death is announced of Colonel Edward Daniel Meier, past president of the American Society of Mechanical Engineers.

Fayette Clay Ewing, Jr., associate professor of civil engineering in the University of the South, died suddenly of heart failure at Sewanee, Tenn., on November 28. Mr. Ewing, who was in the twenty-eighth year of his age, was a young engineer and teacher of marked promise. He graduated at the University of Virginia in 1910 with the degree of C.E., and, before going to Sewanee last May, had been connected with railway practise.

Archibald Ross Colquhoun, the British traveler and explorer, died on December 18, at the age of sixty-six years.

Dr. Charles Périer, president of the French Academy of Medicine, one of the most distinguished surgeons in France, died on December 13, aged seventy-eight years.

Among those killed in the war are: Dr. Alfred Grund, professor of geography in the German University of Prague; Dr. Franz Waterstradt, professor of agriculture in the Agricultural School at Hohenheim; Dr. Fritz Ludwig Kohlrausch, professor for work in radium in the mining school at Freiburg, and Dr. Fricke, professor of forestry in the Forest Academy at Münden.

Large bequests for public purposes are made by the will of Mrs. Mary Anna Palmer Draper, to whom in her lifetime science was greatly indebted for intelligent and generous support. Mrs. Draper bequeaths $150,000 to the Harvard College Observatory for the Draper memorial, established in memory of Dr. Henry Draper, her husband, whose photographic plates and apparatus are also bequeathed to the observatory. The sum of $450,000 is given to the New York Public Library, $200,000 for a memorial to Dr. John S. Billings, and $200,000 as a memorial to her father, Courtland Palmer. The income of these funds is to be used for the purchase of books, and an additional trust fund of $50,-

000 is given for the benefit of the employees of the library. There is also a bequest of $25,000 to the Smithsonian Institution; a bequest of objects of art with $20,000 for their care to the Metropolitan Museum; of $50,000 to the New York Polyclinic Hospital; of $25,000 to the New York Skin and Cancer Hospital, and of $25,000 to the laboratory of surgical research of New York University, of whose medical department Dr. Henry Draper was at one time dean.

SECTION L—Education—of the American Association for the Advancement of Science, of which the chairman is Professor Paul H. Hanus, of Harvard University, and the secretary, Stuart A. Courtis, has arranged a two-days' program, that of Wednesday, December 30, being devoted to educational measurement, and that of Thursday, December 21, to the exceptional child. In the mornings there will be presented some thirty ten-minute papers, giving the results of researches on these subjects, and on each afternoon there will be four half-hour addresses. The address of the retiring vice-president and chairman, Dr. P. P. Claxton, U. S. Commissioner of Education, is on the American rural school.

As has already been stated in SCIENCE the American Physiological Society will hold its twenty-seventh annual meeting at St. Louis, Mo., December 27–30. Scientific papers and demonstrations for the meeting have been reported by the following: R. W. Keeton and F. G. Koch; F. S. Lee and C. L. Scott; F. P. Knowlton and A. C. Silvermann; Ida M. Hyde; F. I. Zeman, J. Kohn and P. E. Howe; S. Tashiro; R. S. Pearce; S. Simpson and R. L. Hill; W. L. Gaines; W. B. Cannon, C. A. Binger and R. Litz; C. C. Fowler, M. E. Rehfus and P. B. Hawk; W. H. Spencer, M. E. Rehfus and P. B. Hawk; R. S. Hoskins; H. McGuigan and C. L. v. Hess; W. E. Burge; F. C. MacLean; G. W. Crile, F. W. Hitchings and J. B. Austin; A. L. Beifeld, H. Wheelon and C. R. Lovelette; F. F. Rogers and L. L. Hardt; C. H. Dallwig, A. C. Kolls and A. S. Loevenhart; J. F. McClendon; K. R. Drinker and C. K. Drinker; M. L. Fleisher and L. Loeb; F. S. Lee and D. J. Edwards; B. H. Schlomovitz, J. A. E. Eyster and W. J. Meek; J. A. E. Eyster and W. J. Meek; C. Brooks and A. B. Luckhardt; S. Simpson and A. T. Rasmussen; T. S. Githens and S. J. Meltzer; C. Voegtlin; B. M. Potter; E. G. Martin and P. G. Stiles; M. Dresbach; W. J. Meek and J. A. E. Eyster; E. G. Martin; H. Ginsburg; A. J. Carlson; F. C. Becht and H. McGuigan; H. R. Basinger and A. L. Tatum; C. Voegtlin.

A PRESS dispatch from Denver states that the Federal Commission on Industrial Relations has determined upon an investigation of the country's benevolent organizations. The scope of the investigation is said to be stated by Mr. Frank P. Walsh, chairman of the commission, as follows:

> The commission will investigate the rights, powers and functions of self-perpetuating organizations under their present charters and the extent to which these charters may be stretched under the present Constitution of the United States and the restrictions which present constitutional limitations impose. It will investigate the attitude of high finance toward industrial questions—what organizations such as the Rockefeller Foundation are doing to relieve industrial unrest; how the policies of these organizations are shaped and by whom; what part the source of their income plays in determining what these policies shall be; whether self-perpetuating organizations such as the Rockefeller Foundation are a menace to the future political and economic welfare of the nation; what figure they cut in politics; the labor policy of "Big Business" in general.

A CABLEGRAM to the daily papers says that when the war broke out the Prussian military authorities requisitioned the trained horses of Elberfeld. Dr. Vogel, their owner, protested and the Royal Academy of Berlin supported the protest. A reprieve was granted, but later the horses were requisitioned for an artillery battery and their death on a Flanders battlefield has just been announced. It will be remembered that the "thinking horses" of Elberfeld were first brought to the attention of the public some years ago by their trainer,

Herr K. Krall, who exhibited them at various places in Germany.

In accordance with its usual custom the faculty of medicine of Harvard University will offer a course of free public lectures to be given at the Medical School, on Sunday afternoons, beginning January 3 and ending May 9. The schedule follows:

January 3—Dr. Reid Hunt. Drugs.

January 10—Dr. John Lovett Morse. The care and training of older children.

January 17—Dr. J. L. Goodale. Susceptibility and resistance in diseases of the nose and throat.

January 24—Dr. Alexander Quackenboss. Cataract; its nature and treatment.

January 31.—Dr. William P. Graves. Heredity.

February 7—Dr. S. A. Hopkins. Mouth hygiene as a factor in sickness and health.

February 14—Dr. Harris P. Mosher. Catarrh.

February 21—Dr. George S. Derby. The preservation of the eyesight.

February 28—Dr. Franklin W. White. Food in health and disease. "Food fads." "Health foods." "Vegetarianism."

March 7—Dr. E. G. Martin. Fatigue and rest.

March 14—Dr. F. S. Newell. Modern obstetrics. (To women only.)

March 21—Dr. G. S. C. Badger. Common colds.

March 28—Dr. Percy Brown. The use of X-rays as an aid to our knowledge of disease in the stomach and bowels.

April 4—Dr. R. B. Osgood. The cause and prevention of chronic rheumatism.

April 11—Dr. C. A. Porter. What surgery can do for chronic indigestion.

April 18—Dr. Paul Thorndike. The bladder ailments of man in later life. (To men only.)

April 25—Dr. E. H. Place. What may we do in diminishing the dangers of contagious disease?

May 2—Dr. E. E. Southard. Sex differences in the human brain.

May 9—Dr. W. B. Lancaster. Lighting. Good and bad lighting; its effects on the eyesight.

The *Journal* of the American Medical Association states that the Rockefeller Sanitary Commission which has had in charge the eradication of hookworm in the southern states under the fund of $1,000,000 granted by John D. Rockefeller in 1909, will disband at the close of the present year. The forces of the commission at that time will be withdrawn from all the states in which they have been working except eight, and the work in these will be taken over by the Rockefeller Foundation, a separate organization. The foundation will close up the work in five of the eight states March 1, 1915, and the remaining three on June 30. Under the foundation there has been created an International Commission on Health which will undertake work for the promotion of health in all parts of the world in cooperation with health departments of all countries, and especially will cooperate in the constructive development of state health forces, not alone with reference to hookworm, but in connection with other health conditions.

Another year's laying record of hens bred from selected strains has been compiled by the poultry department of the Oregon station. A flock of fifty hens averaged 213 eggs each during the calendar year, November 1, 1913, to November 1, 1914. If the actual laying year of each hen is counted the average number of eggs laid becomes 220. The world's champion layer, which last year laid 303 eggs in 365 days. has broken the two-year record by the production of 505 eggs in two years, while another hen has averaged more than 200 eggs a year for four years, having laid 819 eggs within that time.

UNIVERSITY AND EDUCATIONAL NEWS

Mr. J. Arthur Beebe has bequeathed $150,000 to the building club of the Harvard Club of Boston; $10,000 to the fund of the Harvard class of 1869, of which class he was a member, though he left before graduation; $10,000 for music at Harvard College, and $5,000 to Dr. F. C. Shattuck for investigations of tropical diseases. The residue of the estate, after some personal bequests have been paid, is bequeathed to Harvard University, the income to be used for the general purposes of the university.

The University of Pennsylvania will be the ultimate beneficiary of the $200,000 estate of William B. Irvine, ex-city treasurer, who died December 6. The money will provide either a building for a school of mining engineering or an auditorium.

THE new building for the Medical College of South Carolina, Charleston, was formally transferred to the board of trustees of the institution, November 18. The address of the occasion was made by Dr. William S. Currell, president of the University of South Carolina.

DR. JOHN HENRY MACCRACKEN, syndic and professor of politics in New York University, has been elected president of Lafayette College. In the same week Dr. Henry Noble MacCracken, professor of English at Smith College, was elected president of Vassar College. They are the sons of Dr. Henry Mitchell MacCracken, chancellor-emeritus of New York University.

PROFESSOR S. F. ACREE, of the Johns Hopkins University, has accepted the position of chief of the Section of Derived Products in the Forest Products Laboratory in Madison and professor of chemistry of forest products in the University of Wisconsin.

MR. DE FOREST HUNGERFORD, instructor in soils in the College of Agriculture, University of Minnesota, has been appointed assistant professor of agronomy in the College of Agriculture, University of Arkansas.

DISCUSSION AND CORRESPONDENCE

RATE OF CONTINENTAL DENUDATION

AT first glance nothing appears more simple than the measurement of the discharge of a large river, and from the volume of matter found to be held in suspension and in solution to calculate the annual depletion of the drainage basin. Ever since the first estimates of Humphreys and Abbot, over half a century ago, the Mississippi River has been a favorite illustration of this kind. Recent results of more elaborate measurements of this character made by the federal government are apparently undertaken with the express purpose of determining the rate of lowering of the continental surface through stream-corrasion.

So soon as a concrete case is settled upon there enters into the problem a number of new and variant factors which, if not perfectly evaluated, utterly invalidate the results sought. In this respect the Mississippi Valley appears to be the most unfortunate choice that it is possible to select. Although the recently published results seem to give excessively small figures and the established rate very much too slow, it is to certain other features that attention is here briefly called, which appear not to have entered into the calculations named.

According to the figures referred to it would take some millions of years to reduce the already low-lying Mississippi basin to the condition of a true peneplain with a position but slightly above tide-level. All direct geologic observations made during late years in the region go to show rather conclusively that in reality the surface of the vast basin is on the whole actually rising instead of becoming notably lower.

Among other factors it appears that the wind-borne dusts from western deserts are alone probably depositing materials over the entire Mississippi Valley faster than the river and its tributaries are carrying rock-waste to the sea. In recent geologic times, also, the western half of the basin has actually had deposits laid down upon its surface to a thickness of not less than 1,000 feet. The great river has not only not been equal to the task of doing its normal amount of work, but it has been so incapacitated as to permit this prodigious volume of rock-waste to accumulate until its original Tertiary surface is already carried far below sea-level. Nowhere on earth is there finer exemplification of vast continental sedimentation.

In the lately compiled estimates of continental lowering several diastrophic factors are left out. These are extremely important in all calculations of this kind. Since Glacial times—perhaps 10,000 years ago—a very considerable part of the upper Mississippi Valley appears to have been elevated not less than 500 to 600 feet. This change of level may represent the isostatic compensation of the last great ice-cap. At any rate, while there has been over this region an erosive loss of a fraction of a foot each century, there has been in the same time a gain in sediments of many times this amount. Growth has exceeded decline a hundred-fold.

The elaborate stream-measurements thus go for naught. They give no clue whatever to the absolute rate of continental lowering through erosion. They merely emphasize the fact of the relative impotency of stream-work in general. They bring into strong contrast the tremendous effects of other geologic agencies of degradation and of aggradation which we have long been accustomed entirely to ignore, or to give only scant consideration.

Charles Keyes

CLADONEMA

In looking up the date for the species of the flagellate protozoon, *Cladonema laxum* Kent 1871 (*Anthophysa laxum* Kent), I found that Seville Kent had proposed for this species the name *Cladonema*,[1] having derived it from the Greek, *klados*, branch, and *nema*, thread. His type species is *C. laxum*, of which he wrote: "This species was first briefly described by the author, with an accompanying figure, in the *Monthly Microscopical Journal* for December, 1871, under the title of *Anthophysa laxa;* the isolated instead of clustered mode of attachment of the animalcules to their pedicle, added to the flexible, thread-like aspect and consistence of their structure, distinguishes it, however, so conspicuously from the representatives of either the genus *Anthophysa* or other allied forms described in this treatise, that a new generic name has been created for its reception," *i. e., Cladonema.*

References to *Cladonema* in the literature earlier than 1880 lead the writer to trace back the name to 1843. In *Ann. des Sci. Nat.* for that year, 11e serie (Zoologie), Tome 20, pp. 370–3, Dujardin listed a new medusa, for which he proposed the name *Cladonema radiatum.* This form had developed from the hydroid *Stauridium* (see description, p. 372). Krohn in 1853[2] accepted the name for the medusa, and only differed from Dujardin's interpretation in minor points in the development into the *Stauridium.* Others to recognize the name *Cladonema* for the medusa prior to 1880 are: Kefferstein und Ehlers, 1861, *Zool. Beitraege,* Neapel, Messina, p. 85, taf. 13, Fig. 5; Van Beneden, 1866, *Mem. Acad. Roy. Belgique,* Tome 36, p. 139, pl. 12; Hincks, 1868, "Hist. Brit. Hydroid. Zooph.," p. 62, pl. 11; Allman, 1872, "Monog. Tubul. Hydroids," pp. 216, 357, pl. 17, Figs. 1–10; and Haeckel, 1879, "Syst. der Medusen," p. 109.

Mayer, in his "Medusa of the World," Pt. I. (Carnegie Inst. Pub.), 1910, recognizes the name *Cladonema* for the medusa form and gives the full bibliography (p. 99). In Pt. III. of this work, p. 719, he writes under the caption "Preoccupied Generic Names":

> The establishment of the Commission upon Zoological Nomenclature and the general recognition which the code that controls its decision has won for itself among naturalists makes it more than ever desirable that the validity of the generic names we now use should be firmly established. Accordingly, the tenability of each and every generic name adopted in this work has been made the subject of thorough research, and I am somewhat surprised to find that names which have been used for generations without question of their priority are actually preoccupied for other groups of animals and can not be applied to the medusæ.

He lists five such cases, *Corynitis, Slaberia, Turris, Tiara* and *Laodicea. Cladonema,* however, remains established for the medusa form.

It seems evident from the above that Kent proposed the name *Cladonema* for the Infusorian without knowing that the name was already occupied. Hence the former name *Anthophysa* Bory, 1822 (?), must be revived for the reception of this species, or a new name proposed.

E. Carroll Faust
Missoula County High School,
Missoula, Mont.

[1] Manual of the Infusoria, Vol. I., London, 1880, pp. 264–65.

[2] *Mueller's Arch. f. Anat. u. Physiol.,* 1853, p. 420.

SCIENTIFIC BOOKS

The British Rust Fungi (Uredinales), their Biology and Classification. By W. B. Grove, M.A. Cambridge, at the University Press. 1913. Pp. xii + 412.

The author of the excellent four-hundred-page volume treating of the British rust fungi has most appropriately begun his preface by reference to the eminent achievements of Plowright embodied in a similar volume twenty-four years previously. Plowright's volume contained a large amount of original matter derived from observation and experiment. In his conception of the *Uredinales* Plowright stood head and shoulders above his English co-workers. He was a leader among British uredinologists.

The volume by Mr. Grove is a worthy successor to Plowright's commanding work. Even if it does not measure up to its prototype in leadership, it can justly be said to present the interesting group of rust fungi, as represented in England and Scotland, in a serviceable and acceptable manner.

In the eighty-four pages devoted to the general part of the work the author has begun by giving in detail the life history of *Puccinia Caricis,* sensibly selecting it instead of the usual *P. graminis* as a typical example of a rust, supplemented by a briefer account of eight other species. Then are successively discussed spore-forms and groupings in accordance with their succession, sexuality including nuelear division, specialization, immunity and phylogeny.

In the larger systematic part of the volume about two hundred and fifty species are described, and nearly all illustrated with original outline drawings. The general plan of the systematic part is modelled after Sydow's "Monographia Uredinearum." The illustrations are superior to those in that work, and approach those of Fischer's "Uredineen der Schweiz," while the method of description is similar to that introduced by the writer in the "North American Flora." Recognition of the diagnostic value of the pores in the urediniospores is especially noteworthy. The technical description is followed by helpful notes for most of the species. Placing that part of the technical description derived from extra-territorial material in brackets promotes clearness and accuracy. The synonymy is said "to show the origin and authority of the name used," as well as to include references to well-known works, the name for each species being selected in accordance with the "principle of priority" as restricted by the International Rules of 1905 and 1910, yet to one who has carefully looked into the history of rust names the result appears to accord more with what one might designate acceptable usage rather than the rigid application of any uniform rules.

If one accepts the conservative standpoint of the author there is nothing of importance in the work that calls for adverse criticism. Both author and publisher are to be commended for the excellence of the volume.

It may be pointed out that in the author's zeal to illustrate with British material a kind of spore which does not occur in connection with any rust in Great Britain, the identical cut which does service as a urediniospore on page 208 is reproduced on page 34 in the general part as an amphispore, although the text says it is only the "nearest approach" to be found among British species. What harm could have come from illustrating a kind of spore not found in Britain by an extra-British example is a mystery to a non-Britisher.

It may also be said that the author has doubtless been led into error by accepting the assignment to the genus *Hemileia* of three species of *Uredo* on orchids. The writer has examined original material on which this assumption is founded, and believes that no teleospores have yet been discovered, those supposed to be such being only oblong urediniospores. The morphology of these rusts, as well as their host relationship, is entirely against their inclusion in the genus *Hemileia.*

Exception must be taken to the author's statement that "the genus *Milesia* is now dropped [for the later *Milesina*], because it was founded on an imperfect state which might belong to any one of several genera." It is true that it was founded on an "imperfect state," if the uredineal sori are to be spoken of as such, but wholly untrue that the spores of this stage are not distinctively characteristic

of the genus. Even the author himself shows the fallacy by his drawings, by a statement at bottom of page 377, by his omission of other spore forms in describing the several species, and in his ability to include a species which had not before been assigned to the genus without having seen other than uredinio-spores. The attempt to base modern procedure on antiquated and discredited ideas, which this instance well illustrates, accounts for the unfortunate rule of the Brussels Congress throwing out all names for priority not applied to the telial stage. It is this rule which the author is trying to follow.

There is much to be commended in the author's attempt to bring together so-called species which might more properly be considered races or varieties. His nomenclatorial method of using a collective name and description under which constituents are maintained as if autonomous is, however, contrary to De Candolle's fundamental law of nomenclature that a plant can only bear one name of the same grade, a law that has been upheld by every botanical congress since its enunciation in 1813. If *Puccinia Digraphidis, P. Orchidearum-Phalaridis, P. Winteriana* and *P. Phalaridis* are to be grouped as biological races under *Puccinia sessilis,* which seems quite correct, the nomenclature should be adjusted accordingly. We hope with the author that some one may be found with "more knowledge, or more courage," as he says in the preface. to carry this process to other forms.

It requires both more knowledge *and* more courage to advance the lines of classification beyond familiar grounds than most authors are willing to incorporate in their works. To illustrate from the work before us: On pages 73–75 the author technically describes the five families of the order *Uredinales* and gives a key to the twenty-two genera into which the British species may be distributed, using the now generally accepted succession beginning with the fern rusts and ending with *Uromyces* and *Puccinia,* but in the systematic part of the volume the order is reversed to accord with the old and more familiar way. If the makers of manuals will not incorporate what they believe to be the best knowledge available, how can the general student get a working familiarity with it? Too great conservatism is as injurious to the diffusion of substantial information as too pronounced radicalism.

The author deplores the lack of a suitable way to subdivide the genus *Puccinia* with its enormous number of species, "more than 1,300 are already known." After discarding Schröter's and Fischer's classifications because they "separate nearly allied species," he says "Arthur's is a pathless chaos," and decides to arrange the species according to hosts, instead of introducing a "new imperfect scheme." It is evident that the author did not master the classification proposed by the writer, which is founded upon the combination of life histories and morphological characters. That classification can justly be called imperfect, but not artificial, and by no manner of means chaotic. It is imperfect because more information is demanded than was available when it was proposed, and must be emended and changed to accord with knowledge as it comes to hand, as likely to occur in the establishment of a natural system of any group of plants.

The author has not indicated whether the spore-forms which he describes under each species are all the spore-forms belonging to the species, or not, and without such information species can not be distributed in the Arthur system. How to ascertain this important item was pointed out by the writer in 1904. *Puccinia bullata,* for instance, is credited with pycnia, uredinia and telia, but no mention is made of aecia, and *Puccinia Calthae* has pycnia, aecia and telia described, but no uredinia. About one half the species in the book are thus lacking in definite information. It is no wonder the author saw in the Arthur system only "a pathless chaos."

J. C. Arthur

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Textbook on Wireless Telegraphy. By Rupert Stanley, Professor of Physics and Electrical Engineering, Municipal Technical

Institute, Belfast. Longmans, Green & Co. Pp. 344. 201 illustrations. $2.25 net.

It is seldom that a reviewer has the privilege of examining a book which so well accomplishes its purposes as does this elementary text on radio telegraphy. The author states in the preface that his book is designed to fill the needs of those students who, with practically no previous knowledge of electric circuits, desire to become acquainted with the simple theory of wireless telegraphy and with the various pieces of apparatus at present used in radio work. There is surely no text on the market to-day which fills the needs of such students as well as does Professor Stanley's book.

The subject-matter is all useful, live material and is strictly up to date. The historical development of the subject is given only sufficient space to make the student realize the sequence in which the different pieces of apparatus and circuits appeared in the art. Many texts devote a deal of space to detailed descriptions of the early experiments, but this text is fortunately entirely free from such irrelevant material.

The first five chapters deal with general concepts of magnetism and electricity and introduce the reader to the modern idea of the electric current being motion of electrons. Next follows a chapter on measurements and calculations of series and parallel circuits, voltage, current, power, etc. The material of this chapter is well illustrated by problems worked out in the text. Three chapters are devoted to inductance, capacity and oscillatory discharges, with methods of producing them.

Chapter X., on "How Ether Waves are Propagated and Received," deals with a very difficult subject but the author has treated it exceptionally well, bringing into his discussion, day and night effects, effect of water and dry land, etc., and illustrating his explanations by experimental data.

There are six chapters devoted to the various circuits and pieces of apparatus used in sending and receiving stations where the so-called "damped wave system" or spark system is used and one chapter on the generating and receiving apparatus used in systems using continuous waves. A short discussion on miscellaneous apparatus, such as direction finders, amplifiers, galvanometers, hot-wire meters, etc., is followed by the last chapter of the book in which various measurements of radio circuits and apparatus are described.

Four short appendices are devoted to the standard code, call letters of British stations, extracts from international radio regulations and the system of time signals and weather reports sent out from Eiffel Tower. Questions added at the end of each chapter increase the value of the book as a text.

The paper on which the book is printed is not suitable for fine half tones and these are rather disappointing, but to offset this defect the diagrams of circuits and connections are exceptionally well executed. They show thought and skill on the part of the one who designed them. There are minor errors, such as appear in Figs. 38, 43 and 45, but for a first edition the number of errors is very small. The author and publishers deserve much praise from those interested in radio work for putting out this commendable text.

J. H. M.

BOTANICAL NOTES

SOME CORRECTIONS IN REGARD TO TROPICAL LEAVES

DR. SHREVE'S paper on "The Direct Effects of Rainfall on Hygrophilous Vegetation"[1] will serve as a corrective for some "casual observation and vivid imagination" in regard to certain adaptational features, in tropical vegetation, especially those pertaining to leaf shapes and structures. His studies were made in the Jamaican forests where the rainfall ranges from 266.7 cm. (100 inches) to 426.7 cm. (170 inches), insuring, with the aid of a generally prevalent fog blanket, an almost continual wetness of the foliage. In these conditions it has generally been assumed that the leaves should have dripping points, velvet surfaces, epiphyllæ and hydathodes. And yet Dr. Shreve found "a very weak representation of such features as the hydathode, the

[1] *Journal of Ecology*, June, 1914.

dripping point, the velvet surface, the variegated leaf, drooping juvenile foliage, etc." Upon some of these structures his comments are suggestive, as,

> There is no feature of foliage leaves that appears to give greater promise of having concrete utility under rain-forest conditions than does the hydathode.

Yet in his summary he says:

> Plants possessing hydathodes are very infrequent in the montane rain forests of Jamaica.

So, too, he says: "Plants possessing dripping points are relatively uncommon in the rain-forest," and a little later, "Surface wetness does not lower the temperature of leaves sufficiently, under rain-forest conditions, to affect their transpiration rate."

The paper is so full of interesting results that it is quite impossible to summarize it as a whole, yet one rises from reading it with the feeling that it must do much to correct current notions as to the ecology of tropical leaves.

NORTH AMERICAN FLORA

Part 1 of Volume 29 of this slowly moving publication appeared August 31, 1914. It contains the following families of the Order Ericales: *Clethraceae* by N. L. Britton; *Monotropaceae,* by J. K. Small; *Lennoaceae,* by P. A. Rydberg; *Pyrolaceae,* by P. A. Rydberg, and *Ericaceae,* by J. K. Small. In the last-named family the genus *Arctostaphylos,* now named *Uva-ursi,* is treated by LeRoy Abrams.

PERENNIAL GRASS STEMS

In a recent paper on the "Development of the Culms of Grasses" (exclusive of Bamboos) by R. S. Hole, of the Imperial Forest Service of India,[2] is a paragraph which will be of interest to many a botanist:

> It is a common belief, probably due to a study of the species characteristic of temperate countries, that the culms of grasses are *annual, i. e.,* that they start growth, attain maturity and ripen grain in a period not exceeding twelve months. In some, at least, of the species of considerable economic importance which are dominant in the Savannah lands of our Indian forests this generalization does not hold good. In *Saccharum munja* Roxb. the culms are, as a rule, biennial, and a number of culms of *Saccharum arundinaceum* Retz. are now under observation in the Dehra Experimental Garden which are two years old and which, although still growing vigorously, have not yet attained maturity.

No doubt other cases of perennial stemmed grasses may be found by a little searching. A woody-stemmed south Florida grass (*Panicum latifolium* L.) appears to have a stem which continues to grow for more than one year.

SOME TEMPERATURE RELATIONS OF PLANTS

Several paragraphs in Dr. Shreve's paper on "The Rôle of Winter Temperatures in Determining the Distribution of Plants"[3] are distinctly quotable, and at the same time helpful to a better understanding of some of the temperature relations of plants. As to phenology and phenologists, he says:

> More attention has been given by phenologists to the temperature phases of the growing season, and their potentialities, than to those of the frost season. . . . The gigantic toil of the phenologists between 1850 and 1890 yielded some results on the operation of temperature, and gave us a vast accumulation of data of which some real use was made at the time, and to which we may return in future investigations. . . . Their efforts were handicapped by the fact that they worked extensively rather than intensively, and that they had not a sufficient foundation of physiological facts upon which to operate.
>
> The viewpoint of the geographer—and with him that of many floristic plant geographers—is too broad and general to give due regard to the actual physiological effects of temperature on plants; the point of view of the plant physiologist, on the other hand, is often too intensive to enable him to realize that the "conditions" of his laboratory experiment are identical with the "physical factors" of the environment of plants growing under a state of nature, and he is therefore prone to neglect the bearing of his work on the problems of the field.

From his point of view Dr. Shreve very properly criticizes the system of life zones proposed by Merriam, concluding that

[2] *Forest Bull.* 25, Calcutta, 1914.

[3] *Am. Jour. Bot.,* No. 4, 1914.

in spite of the importance of temperature as a factor in distribution it is illogical to take it as the sole criterion for the limits of distributional regions, especially when the rôle of soil and atmospheric moisture is so obviously of vital importance and is so potent in determining the areas of the principal vegetational regions of the globe.

SHORT NOTES

A YEAR or so ago F. L. Sargent published a helpful little book on applied botany, entitled "Plants and Their Uses" (Holt), and now he adds a helpful 80-page pamphlet of directions to students ("Student's Handbook") to accompany it, and to serve as a laboratory guide.

SOMEWHAT similar in design is Dr. Pool's little book, "Suggestions for Experiments in Plant Physiology" (Univ. Nebr.), consisting of 100 pages. Fifteen illustrations, mostly diagrammatic, supplement the text of very explicit directions.

THE Nature Study Society of Rockford, Ill., has issued a catalogue of "The Trees of Rockford and Vicinity," including 160 species and varieties of native and cultivated trees. Counting the starred names we find that 50 species are natives.

R. A. GORTNER and A. F. Blakeslee show[4] that this very common black mold contains a powerful water-soluble toxin, which is very harmful when injected into different parts of the body of rabbits and guinea-pigs, but apparently not harmful when *fed* to the animals. This paper is presented by the authors as a report of progress.

G. D. FULLER'S "Evaporation and Soil Moisture in Relation to the Succession of Plant Associations"[5] gives some of the results of his studies in the Chicago region. The stations included cottonwood dunes, pine dunes, oak dunes, oak-hickory forests, beech-maple forests and prairies. By graphs and diagrams the results are made evident to the eye.

"A PROVISIONAL List of Parasitic Fungi in Wisconsin,"[6] by J. J. Davis, is a revision of previous lists by Dr. Trelease and J. J. Davis, and brings our knowledge of the parasites of Wisconsin down to date. The list is in two parts, the first being systematic as to the fungi, and the second being an alphabetical list of hosts. In the first there are 61 Phycomycetes; 89 Ascomycetes; 418 Fungi Imperfecti; 339 Uredinales (+19 isolated and undetermined forms); 7 Hymenomycetes. The list includes therefore, somewhat more than nine hundred fungi (914 + 19).

OTHER recent short papers are J. F. Clevenger's "Effect of the Soot in Smoke on Vegetation";[7] R. M. Harper's "Coniferous Forests of Eastern North America";[8] J. E. Weaver's "Evaporation and Plant Succession in South Eastern Washington and Adjacent Idaho";[9] Darsie, Elliott and Peirce's "Study of the Germinating Power of Seeds";[10] Babcock's "Studies in Juglans," II.;[11] H. S. Jackson's "New Pomaceous Rust of Economic Importance, *Gymnosporangium blasdaleanum*";[12] Michael Levine's "Origin and Development of the lamellae in *Coprinus micaceous*";[13] and W. A. Cannon's "Specialization in Vegetation and in Environment in California."[14]

CHARLES E. BESSEY
THE UNIVERSITY OF NEBRASKA

SPECIAL ARTICLES

HADROPTERUS PELTATUS IN THE DELAWARE

SEVERAL interesting local fishes have come to my notice during the past season, the principal of which was a fine large shielded darter, *Hadropterus peltatus*. It was secured in a small pool of rapid water in the course of Skippack Creek, a tributary of the Perkiomen Creek in Montgomery County, on October 24,

[4] "Observations on the Toxin of *Rhizopus nigricans*," *Am. Jour. Physiol.*, July, 1914.
[5] *Bot. Gaz.*, September, 1914.
[6] *Trans. Wis. Acad. Sci.*, October, 1914.
[7] Bull. 7, Mellon Institute.
[8] *Pop. Sci. Mo.*, October, 1914.
[9] *Plant World*, October, 1914.
[10] *Bot. Gaz.*, August, 1914.
[11] Univ. Calif. Pub., October, 1914.
[12] *Phytopathology*, August, 1914.
[13] *Am. Jour. Bot.*, July, 1914.
[14] *Plant World*, August, 1914.

1914. This is, therefore, the first instance of its occurrence in the basin of the Delaware River, as well as the most eastern and northern locality at which the species has been obtained. The species is of further interest in not having been secured in Pennsylvania since its discovery in the Conestoga in 1864, by Jacob Stauffer. The type, Stauffer's specimen, has been compared in this connection, and agrees in most all respects. It is, however, over three inches in length, though in various works the species is given as of smaller size. Recently Messrs. Radcliffe and Welsh have described a darter from Swan Creek, Maryland, as new, under the name *H. sellaris*. My example differs in having the spinous dorsal more conspicuously lower than the rayed dorsal, one more dorsal spine, naked cheeks and coloration. The additional dorsal spine would appear an intermediate character. *H. sellaris* is shown with the spinous dorsal marked with three dark blotches to each spine, whereas in my example, at present, the dark blotches are only on the membranes. The dark blotches on the back are such as may easily admit of change with age, the Swan Creek specimens being small. Besides the crustaceans *Asellus communis* and *Gammarus fasciatus*, other fishes found in Skippack Creek were *Notropis procne, N. whipplii analostanus, N. cornutus, Rhinichthys atronasus, Fundulus diaphanus* and *Boleosoma nigrum olmstedi*. In the brook near Rahn, another Perkiomen tributary, *Semotilus atromaculatus, Catostomus commersonnii* and *Micropterus dolomieu* were found, and in Landis Brook near Grater's Ford, besides *Fundulus* and *Rhinichthys, Notropis whipplii analostanus* and *Lepomis auritus*.

In the Delaware and its tributaries in Bucks County I met with several species of local interest. One was the *Exoglossum maxillingua* in the river at Morrisville, on July 22, with *Notropis hudsonius amarus, N. whipplii analostanus, Fundulus heteroclitus macrolepidotus, F. diaphanus, Lepomis* and *Boleosoma*, showing its association with upper tidal species. In a small tributary above Yardley, *Notropis bifrenatus, N. whipplii analostanus, N. cornutus, Rhinichthys, Catostomus* and *Boleosoma* were common. In Taylorville, Knowles and Pidcock's Creeks, *Semotilus atromaculatus, Notropis bifrenatus, N. whipplii analostanus, N. cornutus, Rhinichthys, Fundulus diaphanus, Lepomis* and *Boleosoma* were about equally abundant. *Pimephales notatus* and *Semotilus bullaris* were peculiar to Taylorville Creek, while *Hybognathus nuchalis regius* and *Esox americanus* were only found in Knowles, and *Catostomus* occurred in both. This is the first instance of *Pimephales* in this section, though I have it from further west, or the Schuylkill. *Rhinichthys* was the only fish found in Cutaloosa Creek. In Brock Creek near Roelofs, *Esox americanus, Notropis cornutus, Erimyzon sucetta oblongus* and *Boleosoma* were found, the last two also occurring in isolated pools in the course of Common Creek near Fallsington, associated with *Notropis bifrenatus, Aphredoderus sayanus* and *Enneacanthus gloriosus*. The last species was also met with in the creek near the village of Penn's Manor, with *Abramis crysoleucas, Ameiurus nebulosus, Schilbeodes gyrinus, Fundulus diaphanus, Apeltes quadracus, Lepomis auritus* and *Eupomotis gibbosus*. In Chester County, in the various headwaters of the White Clay Creek, near Londongrove, only *Salvelinus fontinalis, Rhinichthys* and *Boleosoma* were met with abundantly.

Henry W. Fowler
Academy of Natural Sciences
of Philadelphia,
October 31, 1914

THE CONVOCATION WEEK MEETING OF SCIENTIFIC SOCIETIES

The American Association for the Advancement of Science and the national scientific societies named below will meet at Philadelphia, during convocation week, beginning on December 28, 1914:

American Association for the Advancement of Science.—President, Dr. Charles W. Eliot, Harvard University; retiring president, Professor Edmund B. Wilson, Columbia University; permanent secretary, Dr. L. O. Howard, Smithsonian Institution, Washington, D. C.; general secretary,

Professor William A. Worsham, Jr., State College of Agriculture, Athens, Ga.; secretary of the council, Mr. Henry Skinner, Academy of Natural Sciences, Logan Square, Philadelphia, Pa.

Section A—Mathematics and Astronomy.—Vice-president, Professor Henry S. White, Vassar College; secretary, Professor Forest R. Moulton, University of Chicago, Chicago, Ill.

Section B—Physics.—Vice-president, Professor Anthony Zeleny, University of Minnesota; secretary, Dr. W. J. Humphreys, U. S. Weather Bureau, Washington, D. C.

Section C—Chemistry.—Vice-president, Provost Edgar F. Smith, University of Pennsylvania; secretary, Dr. John Johnston, Geophysical Laboratory, Washington, D. C.

Section D—Mechanical Science and Engineering.—Vice-president, Albert Noble, New York; secretary, Professor Arthur H. Blanchard, Columbia University, New York City.

Section E—Geology and Geography.—Vice-president, Professor U. S. Grant, Northwestern University; secretary, Professor George F. Kay, University of Iowa.

Section F—Zoology.—Vice-president, Professor Frank R. Lillie, University of Chicago; secretary, Professor Herbert V. Neal, Tufts College, Mass.

Section G—Botany.—Vice-president, Dr. G. P. Clinton, Connecticut Agricultural Experiment Station; secretary, Professor W. J. V. Osterhout, Harvard University, Cambridge, Mass.

Section H—Anthropology and Psychology.—Vice-president, Dr. Clark Wissler, American Museum of Natural History; secretary, Professor George Grant MacCurdy, Yale University, New Haven, Conn.

Section I—Social and Economic Science.—Secretary, Seymour C. Loomis, 69 Church St., New Haven, Conn.

Section K—Physiology and Experimental Medicine.—Vice-president, Professor Richard Mills Pearce, University of Pennsylvania; secretary, Dr. Donald R. Hooker, Johns Hopkins Medical School, Baltimore, Md.

Section L—Education.—Vice-president, Professor Paul H. Hanus, Harvard University; secretary, Dr. Stuart A. Courtis, Liggett School, Detroit, Mich.

Section M—Agriculture.—Vice-president, Professor L. H. Bailey, Cornell University; secretary, Dr. E. W. Allen, U. S. Department of Agriculture, Washington, D. C.

The American Physical Society.—Convocation Week. President, Professor Ernest Merritt, Cornell University; secretary, Professor A. D. Cole, Ohio State University, Columbus, Ohio.

The American Federation of Teachers of the Mathematical and the Natural Sciences.—December 29. President, Professor C. R. Mann, Carnegie Foundation, New York City; secretary, Dr. Wm. A. Hedrick, McKinley Manual Training School, Washington, D. C.

The American Society of Naturalists.—December 31. President, Professor Samuel F. Clarke, Williams College; secretary, Dr. Bradley M. Davis, University of Pennsylvania, Philadelphia, Pa.

The American Society of Zoologists.—December 29–31. President, Professor C. E. McClung, University of Pennsylvania; secretary, Dr. Caswell Grave, The Johns Hopkins University, Baltimore, Md.

The Society of American Bacteriologists.—December 29–31. President, Professor Charles E. Marshall, Massachusetts Agricultural College; secretary, Dr. A. Parker Hitchens, Glenolden, Pa.

The Entomological Society of America.—December 31–January 1. President, Professor Philip P. Calvert, University of Pennsylvania; secretary, Professor Alexander D. MacGillivray, University of Illinois, Urbana, Ill.

The American Association of Economic Entomologists.—December 28–31. President, Professor H. T. Fernald, Amherst College; secretary, A. F. Burgess, Melrose Highlands, Mass.

The Geological Society of America.—December 29–31. President, Dr. George F. Becker, U. S. Geological Survey, Washington, D. C.; secretary, Dr. Edmund Otis Hovey, American Museum of Natural History, New York City.

The Paleontological Society.—December 29–31. President, Dr. Henry F. Osborn, American Museum of Natural History, New York City; secretary, Dr. R. S. Bassler, U. S. National Museum, Washington, D. C.

The Botanical Society of America.—December 29–January 1. President, Dr. A. S. Hitchcock, U. S. Department of Agriculture; secretary, Dr. George T. Moore, Botanical Garden, St. Louis, Mo.

The American Phytopathological Society.—December 29–January 1. President, Dr. Haven Metcalf, U. S. Department of Agriculture; secretary, Dr. C. L. Shear, U. S. Department of Agriculture, Washington, D. C.

American Fern Society.—December 28–29. Secretary, Charles A. Weatherby, 749 Main St., East Hartford, Conn.

Sullivant Moss Society.—December 30. Secretary, Edward B. Chamberlain, 18 West 89th St., New York, N. Y.

American Nature-Study Society.—December 30–31. Secretary, Professor E. R. Downing, University of Chicago, Chicago, Ill.

School Garden Association of America.—December 29–30. President, Van Evrie Kilpatrick, 124 West 30th St., New York, N. Y.

American Alpine Club.—January 2. Secretary, Howard Palmer, New London, Conn.

American Association of Official Horticultural Inspectors.—December 29–30. Chairman, Dr. W. E. Britton, New Haven; secretary, Professor J. G. Saunders, Madison, Wis.

The American Microscopical Society.—December 29. President, Professor Charles Brookover, Little Rock, Ark.; secretary, T. W. Galloway, James Millikin University, Decatur, Ill.

The American Anthropological Association.—December 28–31. President, Professor Roland B. Dixon, Harvard University; secretary, Professor George Grant MacCurdy, Yale University, New Haven, Conn.

The American Folk-Lore Society.—Convocation Week. President, Dr. P. E. Goddard, American Museum of Natural History, New York City; secretary, Dr. Charles Peabody, 197 Brattle St., Cambridge, Mass.

The American Psychological Association.—December 30–January 1. President, Professor R. S. Woodworth, Columbia University; secretary, Professor R. M. Ogden, University of Tennessee, Nashville, Tenn.

The Southern Society for Philosophy and Psychology.—December 31–January 1. President, Professor John B. Watson, The Johns Hopkins University; secretary, Professor W. C. Ruediger, George Washington University, Washington, D. C.

The American Association for Labor Legislation.—December 28–29. President, Professor Henry R. Seager, Columbia University; secretary, Dr. John B. Andrews, 131 East 23d St., New York City.

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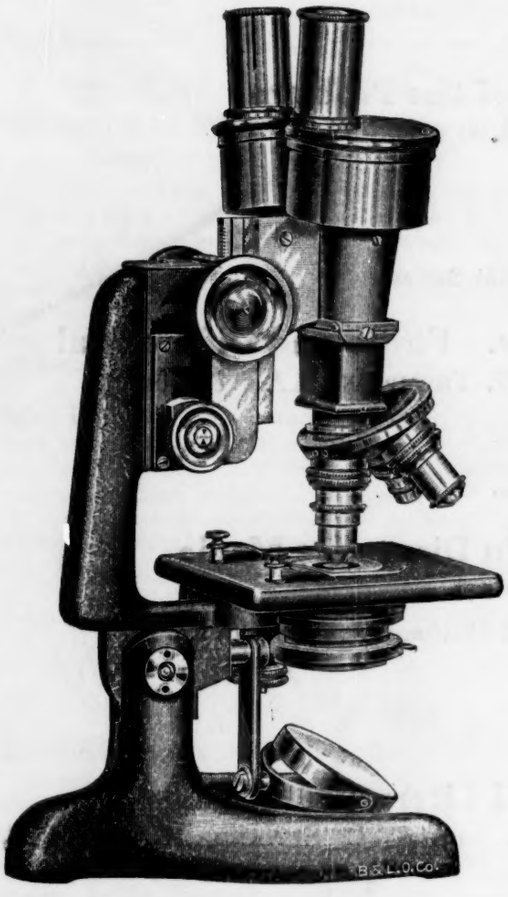

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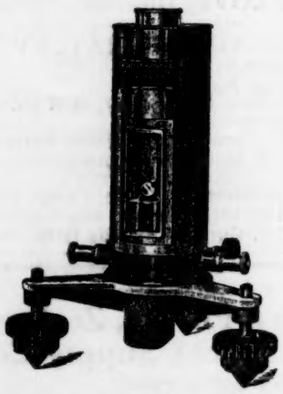

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COURSE OF MEDICAL STUDY—Four years of graded instruction given in modern laboratories, hospitals and outpatient department, followed by a fifth year in interne hospital service in approved institutions, or a year of advanced study in the laboratories of this School.

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TEACHING FELLOWSHIPS—Opportunity is offered in the clinical departments for a limited number of men who desire to devote two to four years to the study of special branches of medicine; assisting, meanwhile, in the conduct of clinical work and teaching.

SCHOOL OF PUBLIC HEALTH—Courses are being arranged for medical and lay health officers, in addition to the regular studies in hygiene proper to the medical curriculum.

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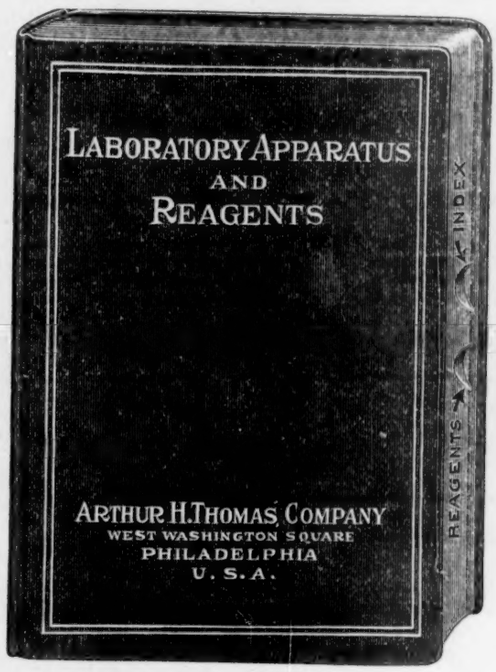

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